MBDA National Director (Recommending Official) with a ranking of the applications based on the average of the reviewers' scores and shall also provide a recommendation regarding funding of the highest scoring application.

3. Oral Presentation—Upon MBDA Request

MBDA may invite the two (2) top-ranked applicants to develop and provide an oral presentation. If an oral presentation is requested, the affected applicants will receive a formal communication (via standard mail, e-mail or fax) from MBDA indicating the time and date for the presentation. In-person presentations are not mandatory but are encouraged; telephonic presentations are acceptable. Applicants will be asked to submit a PowerPoint presentation (or equivalent) to MBDA that addresses the oral presentation criteria set forth above. The presentation must be submitted at least 24 hours before the scheduled date and time of the presentation. The presentation will be made to the MBDA National Director (or his/her designee) and up to three senior MBDA staff who did not serve on the original review panel. The oral panel members may ask follow-up questions after the presentation. MBDA will provide the teleconference dial-in number and pass code. Each applicant will present to MBDA staff only; competitors are not permitted to listen (and/or watch) other presentations.

All costs pertaining to this presentation shall be borne by the applicant. MBEC award funds may *not* be used as a reimbursement for this presentation. MBDA will not accept any requests or petitions for reimbursement.

The oral panel members shall score each presentation in accordance with the oral presentation criterion provided above. An average score shall be compiled and added to the score of the original panel review.

4. Final Recommendation

The MBDA National Director makes the final recommendation to the Grants Officer regarding the funding of one application under this competitive solicitation. MBDA expects to recommend for funding the highest ranking application, as evaluated and recommended by the review panel and taking into account oral presentations (as applicable). However, the MBDA National Director may not make any selection, or he may select an application out of rank order for the following reasons:

(a) A determination that an application better addresses one or more of the funding priorities for this competition. The National Director (or his/her designee) reserves the right to conduct one or more site visits (subject to the availability of funding), in order to make a better assessment of an applicant's capability to achieve the funding priorities; or

(b) The availability of MBDA funding.

Prior to making a final recommendation to the Grants Officer, MBDA may request that the apparent winner of the competition provide written clarifications (as necessary) regarding its application.

Intergovernmental Review: Applications under this program are not subject to Executive Order 12372, ''Intergovernmental Review of Federal Programs.''

Limitation of Liability: In no event will MBDA or the Department of Commerce be responsible for proposal preparation costs if this program fails to receive funding or is cancelled because of other MBDA or Department of Commerce priorities. All funding periods are subject to the availability of funds to support the continuation of the project and the Department of Commerce and MBDA priorities. Publication of this notice does not obligate the Department of Commerce or MBDA to award any specific cooperative agreement or to obligate all or any part of available funds.

Universal Identifier: Applicants should be aware that they will be required to provide a Dun and Bradstreet Data Universal Numbering system (DUNS) number during the application process. *See* the June 27, 2003 **Federal Register** notice (68 FR 38402) for additional information. Organizations can receive a DUNS number at no cost by calling the dedicated toll-free DUNS Number request line at 1–866–705–5711 or by accessing the Grants.gov Web site at *http://www.Grants.gov*.

Department of Commerce Pre-Award Notification Requirements for Grants and Cooperative Agreements: The Department of Commerce Pre-Award Notification Requirements for Grants and Cooperative Agreements contained in the **Federal Register** notice of December 30, 2004 (69 FR 78389) are applicable to this solicitation.

Paperwork Reduction Act: This document contains collection-of-information requirements subject to the Paperwork Reduction Act (PRA). The use of Standard Forms 424, 424A, 424B, SF-LLL, and CD–346 have been approved by OMB under the respective control numbers 0348–0043, 0348–0044, 0348–0040, 0348–0046, and 0605–0001. Notwithstanding any other provisions of law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with a collection of information subject to the Paperwork Reduction Act unless that collection displays a currently valid OMB Control Number.

Executive Order 12866: This notice has been determined to be not significant for purposes of E.O. 12866.

Administrative Procedure Act/Regulatory Flexibility Act: Prior notice and an opportunity for public comment are not required by the Administrative Procedure Act for rules concerning public property, loans, grants, benefits, or contracts (5 U.S.C. 533(a)(2)). Because notice and opportunity for comment are not required pursuant to 5 U.S.C. 533 or any other law, the analytical requirements of the Regulatory Flexibility Act (5 U.S.C 601 *et seq.*) are inapplicable. Therefore, a regulatory flexibility analysis is not required and has not been prepared.

Dated: December 13, 2007.

Edith Jett McCloud,

Associate Director for Management, Minority Business Development Agency.

[FR Doc. E7–24475 Filed 12–17–07; 8:45 am]

BILLING CODE 3510–21–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[RIN 0648–XE34]

Small Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey off Central America, February–April 2008

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental take authorization; request for comments.

SUMMARY: NMFS has received an application from Lamont-Doherty Earth Observatory (L–DEO), a part of Columbia University, for an Incidental Harassment Authorization (IHA) to take marine mammals incidental to conducting a marine seismic survey off Central America during February–April 2008. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an IHA to L–DEO to incidentally take, by Level B harassment only, small numbers of several species of marine mammals during the aforementioned activity.

DATES: Comments and information must be received no later than January 17, 2008.

ADDRESSES: Comments on the application should be addressed to P. Michael Payne, Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225. The mailbox address for providing e-mail comments is *PR1.0648XE34@noaa.gov*. Comments sent via e-mail, including all attachments, must not exceed a 10-megabyte file size.

A copy of the application containing a list of the references used in this document may be obtained by writing to the address specified above, telephoning the contact listed below (see **FOR FURTHER INFORMATION CONTACT**), or visiting the internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*.

Documents cited in this notice may be viewed, by appointment, during regular business hours, at the aforementioned address.

FOR FURTHER INFORMATION CONTACT: Candace Nachman, Office of Protected Resources, NMFS, (301) 713–2289.

SUPPLEMENTARY INFORMATION:

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

Authorization shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined ''negligible impact'' in 50 CFR 216.103 as '' * * * an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.''

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as:

any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

Section 101(a)(5)(D) establishes a 45-day time limit for NMFS review of an application followed by a 30-day public notice and comment period on any proposed authorizations for the incidental harassment of marine mammals. Within 45 days of the close of the comment period, NMFS must either approve or deny the authorization.

Summary of Request

On August 24, 2007, NMFS received an application from L–DEO for the taking, by Level B harassment only, of small numbers of 26 species of marine mammals incidental to conducting, under a cooperative agreement with the National Science Foundation (NSF), a seismic survey in the Pacific Ocean and Caribbean Sea off Central America as part of the Subduction Factory (SubFac) initiative of NSF's MARGINS program from January–March, 2008. (The dates of the cruise were subsequently moved to the February–April 2008 timeframe.) The MARGINS program was developed to facilitate the study of continental margins. The SubFac initiative will determine the inputs, outputs, and controlling processes of subduction zone systems by obtaining seismic measurements of magma flux, arc composition, and lower-plate serpentinization at the Central American Focus Site.

Description of the Activity

The seismic survey will involve one source vessel, the R/V *Marcus G. Langseth* (*Langseth*), which will operate in two regions during the proposed survey: the Caribbean Sea and the Pacific Ocean. The *Langseth* will deploy an array of 36 airguns (6,600 in^3) as an energy source and, at times, a receiving system consisting of a 6-km (3.7-mi) towed hydrophone streamer. The streamer will be towed at a depth of 5–8 m (16–26 ft). As the airgun array is towed along the survey lines, the hydrophone streamer will receive the returning acoustic signals and transfer the data to the on-board processing system. In the Caribbean region, the *Langseth* will also deploy Ocean Bottom Seismometers (OBSs) to receive the returning acoustic signals. In the Pacific Ocean, a second vessel, the R/V *New Horizon,* will deploy and retrieve the OBSs.

For the first part of the cruise, the *Langseth* is expected to depart Puerto Limon, Costa Rica, on approximately February 3, 2008 for the study area in the Caribbean Sea (see Figure 1 in the application). The seismic survey will commence following the transit and deployment of the streamer and airgun array. Following approximately 25 days of surveying in the Caribbean Sea, all equipment will be recovered, and the vessel will return to Puerto Limon on approximately March 5, 2008. The vessel will then transit through the Panama Canal, likely taking on fuel in Panama. The second part of the survey will commence in the Pacific Ocean on approximately March 11, 2008 from Puerto Caldera, Costa Rica. The Pacific survey is estimated to last approximately 25 days. Currently, the vessel is scheduled to arrive at an unspecified port (likely in Panama) on April 6, 2008. The order of the two surveys may be reversed due to logistics, if necessary. The exact dates of the activities depend upon logistics, as well as weather conditions and/or the need to repeat some lines if data quality is substandard.

The Central American SubFac survey will encompass the area from 9.6° – 14° N., 82° – 83.8° W. in the Caribbean Sea and the area 8° – 11.5° N., 83.6° – 88° W. in the Pacific Ocean (see Figure 1 in the application). Water depths in the survey area range from less than 100 m (328 ft) to greater than 2,500 m (8,202 ft). The seismic survey will take place in the Exclusive Economic Zones (EEZ) of Costa Rica and Nicaragua.

The marine seismic survey will consist of approximately 2,149 km (1,335 mi) of unique survey lines: 753 km (468 mi) in the Caribbean and 1,396 km (867 mi) in the Pacific (see Table 1 in the application). With the exception of two lines (D and E) located in shallow to intermediate-depth water, all lines will be shot twice, once at approximately a 50 m (164 ft; 20-s) shot spacing for multichannel seismic data and once at approximately a 200 m (656 ft; 80-s) shot spacing for OBS refraction data, for a total of approximately 3,980 km (2,473 mi) of survey lines (see Table 1 in the application). The approximate numbers of line kilometers expected to be surveyed in the Pacific and Caribbean in three different water depth categories are shown in Table 2 of the application. There will be additional operations associated with equipment testing, startup, line changes, and repeat coverage of any areas where initial data quality is substandard. There may also be an additional 77 km (48 mi) of survey effort in the Pacific Ocean around Culebra off Nicoya Peninsula not reflected in Table 1 of L–DEO's application. These additional six transect lines will occur in water greater than 100 m (328 ft) deep and are not expected to increase the number of takes by harassment (see below).

The *New Horizon* will be the dedicated OBS vessel during the Pacific part of the survey and will deploy and retrieve the OBSs. A combination of 85 OBSs (150 total deployments) will be used during the project. A total of 60 OBS deployments will take place in the Caribbean (from the *Langseth*), and 90 deployments will take place in the Pacific from the *New Horizon.*

In addition to the operations of the airgun array, a 12-kHz Simrad EM120 multibeam echosounder (MBES) will be operated from the *Langseth* continuously throughout the cruise. Also, a 3.5-kHz sub-bottom profiler (SBP) will be operated by the *Langseth* during most of the survey and during normal operations by the *New Horizon.*

Vessel Specifications

The *Langseth* has a length of 71.5 m (234.6 ft), a beam of 17 m (55.8 ft), and a maximum draft of 5.9 m (19.4 ft). The ship was designed as a seismic research vessel, with a propulsion system designed to be as quiet as possible to avoid interference with the seismic signals. The ship is powered by two Bergen BRG–6 diesel engines, each producing 3,550 hp, that drive the two propellers directly. Each propeller has four blades, and the shaft typically rotates at 750 rpm. The vessel also has an 800-hp bowthruster. The operation speed during seismic acquisition is typically 7.4–9.3 km/h (4–5 kt). When not towing seismic survey gear, the *Langseth* can cruise at 20–24 km/h (11–13 kt). The *Langseth* has a range of 25,000 km (15,534 mi).

The *New Horizon* will be the dedicated OBS vessel during the Pacific part of the survey and will deploy and retrieve the OBSs. The ship has a length of 51.8 m (170 ft), a beam of 11 m (36 ft), and a maximum draft of 3.7 m (12 ft). The ship is powered by two 850 hp D398 Caterpillar engines. The typical cruising speed is 18.5 km/h (10 kt) with a maximum speed of 22.8 km/h (12.3 kt). The *New Horizon* has a range of 18,000 km (11,185 mi).

Acoustic Source Specifications

Seismic Airguns

During the survey, the airgun array to be used will consist of 36 airguns, with a total volume of approximately 6,600 in^3. The airguns will comprise a mixture of Bolt 1500LL and 1900LL airguns. The array will consist of four identical linear arrays or ''strings'' (see Figure 2 in L–DEO's application). Each string will have ten airguns; the first and last airguns in each string are spaced 16 m (52.5 ft) apart. Nine airguns in each string will be fired simultaneously, while the tenth is kept in reserve as a spare, to be turned on in case of failure of another airgun. The four airgun strings will be distributed across an approximate area of 24 × 16 m (78.7 × 52.5 ft) behind the *Langseth* and will be towed approximately 50–100 m (164–328 ft) behind the vessel. The firing pressure of the array is 2,000 psi. The airgun array will fire in two modes: every 50 m (164 ft; 20 s) or every 200 m (656 ft; 80 s). During firing, a brief (approximately 0.1 s) pulse of sound is emitted. The airguns will be silent during the intervening periods. The airguns will be towed at a depth of 9 or 12 m (29.5 or 39 ft). The dominant frequency components are 0–188 Hz.

Received sound levels have been predicted by L–DEO for the 36-airgun array operating in deep water and for a single 1900LL 40 in^3 airgun to be used during power-downs (see below). The predicted received levels depend upon distance and direction from the airguns. This source, which is directed downward, was found to have an output (0-peak) of 258 dB re 1 μPa m. The maximum relevant depth (2,000 m; 6,562 ft) represents the maximum anticipated dive depth of marine mammals and is relevant for predicting safety or exclusion zones (EZs; see below). A detailed description of L–DEO's modeling effort is provided in Appendix A of the application.

The rms (root mean square) received levels that are used as impact criteria for marine mammals are not directly comparable to the peak or peak-to-peak values normally used to characterize source levels of airgun arrays. The measurement units used to describe airgun sources, peak or peak-to-peak decibels, are always higher than the rms decibels referred to in biological literature. A measured received level of 160 dB rms in the far field would typically correspond to a peak measurement of approximately 170 to 172 dB, and to a peak-to-peak measurement of approximately 176 to 178 dB, as measured for the same pulse received at the same location (Greene, 1997; McCauley *et al.*, 1998, 2000a). The precise difference between rms and peak or peak-to-peak values depends on the frequency content and duration of the pulse, among other factors. However, the rms level is always lower than the peak or peak-to-peak level for an airgun-type source.

Multibeam Echosounder

The Simrad EM120 operates at 11.25–12.6 kHz and is hull-mounted on the *Langseth.* The beamwidth is 1° fore-aft and 150° athwartship. The maximum source level is 242 dB re 1 μPa (rms; Hammerstad, 2005). For deep-water operation, each ''ping'' consists of nine successive fan-shaped transmissions, each 15 ms in duration and each ensonifying a section that extends 1° fore-aft. The nine successive transmissions span an overall cross-track angular extent of about 150°, with 16 ms gaps between the pulses for successive sectors. A receiver in the overlap area between the two sectors would receive two 15-ms pulses separated by a 16-ms gap. In shallower water, the pulse duration is reduced to 5 or 2 ms, and the number of transmit beams is also reduced. The ping interval varies with water depth, from approximately 5 s at 1,000 m (3,280 ft) to 20 s at 4,000 m (13,123 ft; Kongsberg Maritime, 2005).

Sub-Bottom Profiler

The SBP is normally operated to provide information about the sedimentary features and the bottom topography that is simultaneously being mapped by the MBES. The energy from the SBP is directed downward by a 3.5 kHz transducer in the hull of the *Langseth.* The output varies with water depth from 50 watts in shallow water to 800 watts in deep water. The pulse interval is 1 s, but a common mode of operation is to broadcast five pulses at 1-s intervals followed by a 5-s pause.

Safety Radii

NMFS has determined that for acoustic effects, using acoustic thresholds in combination with corresponding safety radii is the most effective way to consistently apply measures to avoid or minimize the impacts of an action, and to quantitatively estimate the effects of an action. Thresholds are used in two ways: (1) To establish a mitigation shut-down or power down zone, i.e., if an animal enters an area calculated to be ensonified above the level of an established threshold, a sound source is powered down or shut down; and (2) to calculate take, in that a model may be used to calculate the area around the sound source that will be ensonified to that level or above, then, based on the estimated density of animals and the distance that the sound source moves, NMFS can estimate the number of marine mammals that may be ‘‘taken’’. NMFS believes that to avoid permanent physiological damage (Level A Harassment), cetaceans and pinnipeds should not be exposed to pulsed underwater noise at received levels exceeding, respectively, 180 and 190 dB re 1 μPa (rms). NMFS also assumes that cetaceans or pinnipeds exposed to levels exceeding 160 dB re 1μPa (rms) may experience Level B Harassment.

The depth at which the source is towed impacts the maximum near-field output and the shape of the frequency spectrum. If the source is towed at a relatively deep depth (e.g., approximately 12 m; 39 ft), the effective source level for sound propagating in near-horizontal directions is substantially greater than if the array is towed at shallower depths (e.g., approximately 9 m; 29.5 ft; see Figure 4 vs. Figure 3 in the application).

Empirical data concerning 180 and 160 dB re 1 μPa distances in deep and/or shallow water were acquired for various airgun configurations during the acoustic calibration study of the R/V *Maurice Ewing's* (*Ewing*) 20-airgun 8,600 in^3 array in 2003 (Tolstoy *et al.,* 2004a, b). The results showed that radii around the airguns where the received level was 160 dB re 1 μPa varied with water depth. Similar depth-related variation is likely for the 180-dB re 1 μPa safety criterion applicable to cetaceans and the 190-dB re 1 μPa radius applicable to pinnipeds, although these were not measured. The L–DEO model does not allow for bottom interactions, and thus is most directly applicable to deep water and to relatively short ranges.

The empirical data indicated that, for deep water (>1,000 m; 3,280 ft), the L–DEO model overestimates the received sound levels at a given distance (Tolstoy *et al.*, 2004a,b). However, to be conservative, the distances predicted by L–DEO's model will be applied to deep-water areas during the proposed study (see Table 3 in the application and Table 1 here). As very few, if any, mammals are expected to occur below 2,000 m (6,562 ft), this depth was used as the maximum relevant depth.

Empirical measurements indicated that in shallow water (<100 m; 328 ft), the L–DEO model underestimates actual levels. In previous L–DEO projects done since the calibration results were obtained by Tolstoy *et al.* (2004a,b), the EZs in shallow water were typically adjusted upward from the values predicted by L–DEO's model by factors of 1.3x to 15x depending on the size of the airgun array and the sound level measured (Tolstoy *et al.*, 2004b). During the proposed cruise, similar factors will be applied to the shallow-water radii (see Table 3 in the application and Table 1 here).

Empirical measurements were not conducted for intermediate depths (100–1,000 m; 328–3,280 ft). On the expectation that results would be intermediate between those from shallow and deep water, a correction factor of 1.5x was applied during former L–DEO cruises to the estimates provided by the model for deep-water situations to obtain estimates for intermediate-depth sites. The correction factor was used during previous L–DEO surveys and will be used during the proposed study for intermediate depths (see Table 3 in the application and Table 1 here).

Table 3 in the application and Table 1 here outline the distances to which sound levels of the various EZs might be received, considering both the 36-airgun array and a single airgun in three different water depths. In deep water, the maximum depth considered is 2,000 m (6,562 ft). If marine mammals are detected within or about to enter the appropriate EZ, the airguns will be powered down (or shutdown if necessary) immediately.

TABLE 1.—PREDICTED DISTANCES TO WHICH SOUND LEVELS ≥190, 180, AND 160 DB RE 1 μPA MIGHT BE RECEIVED IN SHALLOW (<100 M; 328 FT), INTERMEDIATE (100–1,000 M; 328–3,280 FT), AND DEEP (>1,000 M; 3,280 FT) WATER DURING THE CENTRAL AMERICAN SUBFAC SURVEY

Source and volume	Tow depth (m)	Water depth	Predicted RMS distances (m)		
			190 dB	180 dB	160 dB
Single Bolt airgun 40 in^3	9	Deep	12	40	385
		Intermediate	18	60	578
		Shallow	150	296	1050
4 strings 36 airguns 6600 in^3	9	Deep	300	950	6000
		Intermediate	450	1425	6667
		Shallow	2182	3694	8000
4 strings 36 airguns 6600 in^3	12	Deep	340	1120	7400
		Intermediate	510	1680	8222
		Shallow	2473	4356	9867

Because the predictions in Table 3 in the application and Table 1 here are based in part on empirical correction factors derived from acoustic calibration of different airgun configurations than those to be used on the *Langseth* (*cf.* Tolstoy *et al.*, 2004a,b), L–DEO is planning an acoustic calibration study of the *Langseth*'s 36-airgun (6,600 in^3) array, which is scheduled to go out in the Gulf of Mexico in January 2008. Distances where sound levels (e.g., 190, 180, and 160 dB re 1 μPa) are received in deep, intermediate, and shallow water will be determined for various airgun configurations. The empirical data from the calibration study will be used to refine the EZs used during the Central American SubFac survey, if the data are appropriate and available at the time of the survey.

Description of Marine Mammals in the Activity Area

A total of 34 marine mammal species are known to or may occur in the study area off Central America, including 25 odontocete (dolphins and small and large toothed whales) species, six mysticete (baleen whales) species, two pinniped species, and the West Indian manatee. Six of the species that may occur in the project area are listed under the U.S. Endangered Species Act (ESA) as Endangered: The sperm, humpback, sei, fin, and blue whale and the manatee. The West Indian manatee is under the jurisdiction of the U.S. Fish and Wildlife Service and therefore is not considered further in this analysis.

The distribution and occurrence of marine mammal species are different on the Pacific and Caribbean coasts of Central America; therefore, these two areas are discussed separately here and in greater detail in L–DEO's application. Thirty-two species of marine mammals have been documented to occur in Costa Rican waters, most of which are cetaceans (Rodríguez-Herrera *et al.*, 2002). At least 10 of the 32 species are known to occur on the Caribbean side, including the manatee (Rodríguez-Fonseca, 2001 and pers. comm.; Rodríguez-Herrera *et al.*, 2002). Twenty-seven species are known to occur on the Pacific side of Costa Rica, including the California and Galápagos sea lions (see Wade and Gerrodette, 1993; Ferguson and Barlow, 2001; Rodríguez-Fonseca, 2001; Rodríguez-Herrera *et al.*, 2002; Rasmussen *et al.*, 2004; Holst *et al.*, 2005a; May-Collado *et al.*, 2005). In addition there are two other species that could potentially occur in the Pacific study area: the ginkgo-toothed (e.g., Rodríguez-Fonseca, 2001) and Longman's beaked whales (e.g., Pitman *et al.*, 1999; Ferguson and Barlow, 2001). Information on the occurrence, distribution, population size, and conservation status for each of the 34 marine mammal species that may occur in the proposed project area is presented in Table 5 of L–DEO's application.

Caribbean

Studies of marine mammals inhabiting the Caribbean have been scarce (Jefferson and Lynn, 1994; Rodríguez-Fonseca, 2001), and abundance in this area is mostly unknown (Roden and Mullin, 2000). At least one systematic ship-based study employing visual and passive-acoustic survey methods has been undertaken in the eastern Caribbean (Swartz and Burks, 2000; Swartz *et al.*, 2001, 2003). In addition, an extensive visual and acoustic survey was conducted in the SE Caribbean Sea off northern Venezuela from the *Ewing* and the R/V *Seward Johnson II* as part of a marine mammal monitoring program during an L–DEO marine seismic cruise in April-June 2004 (Smultea *et al.*, 2004). Data on the western Caribbean is even more limited.

One mysticete, eight odontocetes, and one sirenian are known to occur in the Caribbean study area (Rodríguez-Fonseca, 2001 and pers. comm.; Rodríguez-Herrera *et al.*, 2002). These include the fin, sperm, short-finned pilot, and killer whale; the bottlenose, Atlantic spotted, and clymene dolphin; tucuxi, Gervais' beaked whale, and West Indian manatee. The last four of these species only occur in the Caribbean part of the study area (see Table 5 of the application). Based on other available information (Swartz and Burks, 2000; Romero *et al.*, 2001; Swartz *et al.*, 2001, 2003; Smultea *et al.*, 2004), an additional five species may potentially occur in the study area: two mysticetes (humpback and Bryde's whale) and three delphinids (pantropical spotted, striped, and rough-toothed dolphin). Pinnipeds are unlikely to be seen in the Caribbean part of the study area. Vagrant hooded seals have been seen in the Caribbean (Rice, 1998; Mignucci-Giannoni and Odell, 2001; Reeves *et al.*, 2002), but are not considered further here. The Caribbean monk seal (*Monachus tropicalis*) is considered extinct (Debrot, 2000; Mignucci-Giannoni and Odell, 2001).

Pacific

Of the 36 marine mammal species known to occur in the eastern tropical Pacific (ETP), 29 may occur in the proposed survey area off the west coast of Costa Rica and Nicaragua (see Table 5 of the application). Seven species that are present in the wider ETP but not in the proposed survey area are excluded from Table 5. They include: Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) and Baird's beaked whale (*Berardius bairdii*), which are seen very occasionally (6 and 2 sightings, respectively, in several years of surveys) in the northernmost portions of the ETP (Ferguson and Barlow, 2001); Long-beaked common dolphin (*Delphinus capensis*), which is known to occur in the northernmost areas of the ETP off Baja California, Mexico, and off the coast of Peru (Heyning and Perrin, 1994); Dusky dolphin (*Lagenorhynchus obscurus*), southern right whale dolphin (*Lissodelphis peronii*), Burmeister's porpoise (*Phocoena spinipinnis*), and long-finned pilot whale (*Globicephala melas*) occur near the Peruvian coast but are unlikely to occur in the present study area (Leatherwood *et al.*, 1991; Van Waerebeek *et al.*, 1991; Brownell and Clapham, 1999; Olson and Reilly, 2002).

Although unlikely, two of the six species of pinnipeds known to occur in the ETP could potentially occur in the proposed project area on rare occasions. These include the California and Galápagos sea lions, which have been documented off western Costa Rica (Acevedo-Gutierrez, 1994; Cubero-Parado and Rodríguez, 1999; Rodríguez-Herrera *et al.*, 2002; May-Collado, 2006, in press). The remaining four pinniped species known from the ETP, the Guadalupe fur seal (*Arctocephalus townsendi*), South American fur seal (*A. australis*), southern sea lion (*Otaria flavescens*), and Galápagos fur seal, are not expected to occur in the survey area because their known ranges are substantially farther north or south of the proposed seismic survey area (Reeves *et al.*, 2002).

Most cetacean research off the west coast of Central America has involved three of the most common, coastal resident species: The bottlenose and coastal pantropical spotted dolphin and humpback whale (May-Collado *et al.*, 2005). The remaining marine mammal populations in the region have not been studied in much detail. The most extensive regional distribution and abundance data that encompass the entire study area come primarily from multi-year vessel surveys conducted in the wider ETP by the NMFS Southwest Fisheries Science Center.

Table 5 of L–DEO's application summarizes the abundance, habitat, and conservation status of all marine mammal species considered likely to occur in the proposed survey area in the Pacific. Based on a compilation of data from 1979 to 2001, many cetaceans within the Pacific EEZ of Costa Rica occur in both oceanic and coastal waters. However, beaked, sperm, dwarf/pygmy sperm, and baleen whales (except for the humpback) occur predominantly in oceanic waters (May-Collado *et al.*, 2005). Bottlenose and pantropical spotted dolphins, as well as the humpback whale, tend to be coastal.

The proposed survey area in the Pacific is part of the ''Central American Bight'', which extends from Guatemala to Ecuador. Costa Rican waters in particular are one of the most biologically productive regions of the world (Philbrick *et al.*, 2001; Rodríguez-Herrera *et al.*, 2002; May-Collado *et al.*, 2005; Ferguson *et al.*, 2006a). The characteristics that likely make this region so productive are linked to the thermal structure of the water column, including a shallow thermocline (see Fielder and Talley, 2006). Two regions within the ETP that are considered to be important to certain species of cetaceans include the Costa Rica Dome (CRD) and the countercurrent thermocline ridge at approximately 10° N. (see Au and Perryman, 1985; Reilly, 1990; Reilly and Thayer, 1990; Fielder, 2002; Ballance *et al.*, 2006).

At least five marine areas are considered ecologically important for different marine mammals off western Costa Rica, including areas near the proposed transect lines (Acevedo and Burkhart, 1998; Rodríguez-Fonseca, 2001; May-Collado *et al.*, 2005; Ferguson *et al.*, 2006a). From north to south, the five areas are as follows: Gulf of Papagayo; Punta Guiones to Cabo

Blanco, southern Nicoya Peninsula; CRD; Quepos-Manuel Antonio National Park region; and Isla del Caño, Golfo Dulce, and Osa Peninsula. Marine mammal species inhabiting these five areas, as well as their seasonal use of the habitats, are described in the species accounts in L–DEO's application.

Table 2 below outlines the species, their habitat and abundance in the proposed project area, and the requested take levels. Additional information regarding the distribution of these species expected to be found in the project area and how the estimated densities were calculated may be found in L–DEO's application.

TABLE 2.—THE HABITAT, ABUNDANCE, AND REQUESTED TAKE LEVELS OF MARINE MAMMALS THAT MAY BE ENCOUNTERED DURING THE PROPOSED CENTRAL AMERICAN SUBFAC SEISMIC SURVEY OFF CENTRAL AMERICA.

Species	Habitat	Abun. in NW Atlantic [1]	Abun. in ETP[2]	Rqstd take in Carib. Sea	Rqstd take in ETP
Odontocetes:					
Sperm whale (C,P) (*Physeter macrocephalus*).	Pelagic	[a]13,190 4,804	26,053 [b]	5	239
Pygmy sperm whale (C*,P) (*Kogia breviceps*).	Deeper water off shelf.	[c]395	N.A.	0	0
Dwarf sperm whale (C*,P) (*Kogia sima*)	Deeper waters off shelf.	[c]395	11,200 [d]	0	856
Cuvier's beaked whale (C*,P) (*Ziphius cavirostris*).	Pelagic	[e]3,513	20,000 90,725 [bb]	0	302
Longman's beaked whale (P?) (*Indopacetus pacificus*).	Pelagic	N.A.	291 [bb]	0	9
Pygmy beaked whale (P) (*Mesoplodon peruvianus*).	Pelagic	N.A.	25,300 [f] 32,678[cc]	0	0
Gingko-toothed beaked whale (P?) (*Mesoplodon ginkgodens*).	Pelagic	N.A.	25,300 [f] 32,678[cc]	0	0
Gervais' beaked whale (C?) (*Mesoplodon europaeus*).	Pelagic	N.A.	N.A.	4	0
Blainville's beaked whale (C*,P) (*Mesoplodon densirostris*).	Pelagic	N.A.	25,300 [f] 32,678[cc]	0	29
Rough-toothed dolphin (C?,P) (*Steno bredanensis*).	Mainly pelagic	[g]2,223	145,900	9	954
Tucuxi (C) (*Sotalia fluviatilis*)	Freshwater and coastal waters.	[h]49 [i]705	N.A.	0	0
Bottlenose dolphin (C,P) (*Tursiops truncatus*).	Coastal, shelf and pelagic.	[j]43,951 [k]81,588	243,500	389	2,380
Pantropical spotted dolphin (C?,P) (*Stenella attenuata*).	Coastal and pelagic	4,439	2,059,100	37	7,560
Atlantic spotted dolphin (C) (*Stenella frontalis*).	Coastal and shelf	50,978	N.A.	440	0
Spinner dolphin (C*,P) (*Stenella longirostris*).	Coastal and pelagic	[g]11,971	1,651,100	0	7,856
Costa Rican spinner dolphin (P) (*Stenella l. centroamericana*).	Coastal	N.A.	N.A.	0	3,358
Clymene dolphin (C?) (*Stenella clymene*).	Pelagic	6,086	N.A.	29	0
Striped dolphin (C*,P) (*Stenella coeruleoalba*).	Coastal and pelagic	94,462	1,918,000	31	8,110
Short-beaked common dolphin (P) (*Delphinus delphis*).	Shelf and pelagic	N.A.	3,093,300	0	14,045
Fraser's dolphin (C*,P) (*Lagenodelphis hosei*).	Pelagic	[g]726	289,300	0	144
Risso's dolphin (C*,P) (*Grampus griseus*).	Shelf and pelagic	20,479	175,800	0	651
Melon-headed whale (C*,P) (*Peponocephala electra*).	Pelagic	[g]3,451	45,400	0	1,315
Pygmy killer whale (C*,P) (*Feresa attenuata*).	Pelagic	[l]6 [g]408	38,900	0	231
False killer whale (C*,P) (*Pseudorca crassidens*).	Pelagic	[g]1,038	39,800	0	479
Killer whale (C,P) (*Orcinus orca*)	Coastal	[g]133 [m]6,600	8,500	10	17
Short-finned pilot whale (C,P) (*Globicephala macrorhynchus*).	Pelagic	[n]31,139	160,200 [n]	36	3,717
Mysticetes:					
Humpback whale (C?,P) (*Megaptera novaeangliae*).	Mainly nearshore waters and banks.	[o]10,400 [p]11,570	NE Pacific 1,391[q]; SE Pacific 2,900[r]	3	101
Minke whale (C*,P) (*Balaenoptera acutorostrata*).	Coastal	[s]3,618 [t]174,000	N.A.	0	0
Bryde's whale (C?,P) (*Balaenoptera edeni*).	Coastal and pelagic	[g]35	13,000 [u]	3	68
Sei whale (C*,P) (*Balaenoptera borealis*).	Pelagic	12– [v]13,000	N.A.	0	0

TABLE 2.—THE HABITAT, ABUNDANCE, AND REQUESTED TAKE LEVELS OF MARINE MAMMALS THAT MAY BE ENCOUNTERED DURING THE PROPOSED CENTRAL AMERICAN SUBFAC SEISMIC SURVEY OFF CENTRAL AMERICA.—Continued

Species	Habitat	Abun. in NW Atlantic [1]	Abun. in ETP[2]	Rqstd take in Carib. Sea	Rqstd take in ETP
Fin whale (C,P) (*Balaenoptera physalus*).	Pelagic	2,814 [t] 30,000	1,851[q]	2	0
Blue whale (C*,P) (*Balaenoptera musculus*).	Coastal, shelf, and pelagic.	[w] 320	1,400	0	15
Sirenian:					
West Indian manatee (C) (*Trichechus manatus manatus*).	Freshwater and coastal waters.	[x] 86 [y] 340	N.A.	0	0
Pinnipeds:					
California sea lion (P) (*Zalophus californianus*).	Coastal	N.A.	237,000–244,000 [z]	0	0
Galápagos sea lion (P?) (*Zalophus wollebaeki*).	Coastal	N.A.	30,000 [aa]	0	0

Note: Abun. = abundance, NWA = Northwest Alantic Ocean, P = may occur off Pacific coast of proposed project area, C = may occur off Caribbean coast of proposed project area, * = very unlikely to occur in proposed project area, ? = potentially possible but somewhat unlikely to occur in proposed project area, N.A. = Not available or not applicable.

[1] For cetaceans, abundance estimates are given for U.S. Western North Atlantic stocks (Waring et al. 2006) unless otherwise noted.
[2] Abundance estimates for the ETP from Wade and Gerrodette (1993) unless otherwise indicated.
[a] g(o) corrected total estimate for the Northeast Atlantic, Faroes-Iceland, and the U.S. east coast (Whitehead 2002).
[b] Whitehead 2002.
[c] This estimate is for Kogia sp.
[d] This abundance estimate is mostly for K. sima but may also include some K. breviceps.
[e] This estimate is for Mesoplodon and Ziphius spp.
[f] This estimate includes all species of the genus Mesoplodon from Wade and Gerrodette (1993).
[g] This estimate is for the northern Gulf of Mexico.
[h] Estimate from a portion of Cayos Miskito Reserve, Nicaragua (Edwards and Schnell 2001).
[i] Estimate from the Cananéia estuarine region of Brazil (Geise et al. 1999).
[j] Estimate for the Western North Atlantic coastal stocks (North Carolina (summer), South Carolina, Georgia, Northern Florida, and Central Florida).
[k] Estimate for the for the Western North Atlantic offshore stock.
[l] Based on a single sighting.
[m] Estimate for Icelandic and Faroese waters (Reyes 1991).
[n] This estimate is for G. macrorhynchus and G. melas.
[o] Estimate for the entire North Atlantic (Smith et al. 1999).
[p] This estimate is for the entire North Atlantic (Stevick et al. 2001, 2003).
[q] Carretta et al. 2007.
[r] Felix et al. 2005.
[s] This estimate is for the Canadian East Coast stock.
[t] Estimate is for the North Atlantic (IWC 2007a).
[u] This estimate is mainly for Balaenoptera edeni but may include some B. borealis.
[v] Abundance estimate for the North Atlantic (Cattanach et al. 1993).
[w] Minimum abundance estimate (Sears et al. 1990).
[x] Antillean Stock in Puerto Rico only.
[y] Antillean Stock in Belize (Reeves et al. 2002).
[z] Estimate for the U.S. stock (Carretta et al. 2007).
[aa] Reeves et al. 2002.
[bb] Ferguson and Barlow 2001 in Barlow et al. 2006.
[cc] This estimate includes all species of the genus Mesoplodon (Ferguson and Barlow 2001 in Barlow et al. 2006).

Potential Effects on Marine Mammals

Potential Effects of Airguns

The effects of sounds from airguns might include one or more of the following: tolerance, masking of natural sounds, behavioral disturbances, and at least in theory, temporary or permanent hearing impairment, or non-auditory physical or physiological effects (Richardson *et al.*, 1995; Gordon *et al.*, 2004; Nowacek *et al.*, 2007). However, it is unlikely that there would be any cases of temporary or especially permanent hearing impairment or any significant non-auditory physical or physiological effects. Also, behavioral disturbance is expected to be limited to relatively short distances.

Tolerance

Numerous studies have shown that pulsed sounds from airguns are often readily detectable in the water at distances of many kilometers. For a summary of the characteristics of airgun pulses, see Appendices A and C (c) of L–DEO's application. Several studies have shown that marine mammals at distances more than a few kilometers from operating seismic vessels often show no apparent response—see Appendix C (e) of the application. That is often true even in cases when the pulsed sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of the mammal group. Although various baleen whales, toothed whales, and (less frequently) pinnipeds have been shown to react behaviorally to airgun pulses under some conditions, at other times, mammals of all three types have shown no overt reactions. In general, pinnipeds and small odontocetes seem to be more tolerant of exposure to airgun pulses than are baleen whales.

Masking

Obscuring of sounds of interest by interfering sounds, generally at similar frequencies, is known as masking. Masking effects of pulsed sounds (even from large arrays of airguns) on marine mammal calls and other natural sounds are expected to be limited, although there are few specific data of relevance. Some whales are known to continue calling in the presence of seismic pulses. The airgun sounds are pulsed, with quiet periods between the pulses, and whale calls often can be heard between the seismic pulses (Richardson *et al.*, 1986; McDonald *et al.*, 1995; Greene *et al.*, 1999; Nieukirk *et al.*, 2004; Smultea *et al.*, 2004). Although there has been one report that sperm whales cease calling when exposed to pulses from a very distant seismic ship (Bowles *et al.*, 1994), a more recent study reports that sperm whales off northern Norway continued calling in the presence of seismic pulses (Madsen *et al.*, 2002). That has also been shown during recent work in the Gulf of Mexico and Caribbean Sea (Smultea *et al.*, 2004; Tyack *et al.*, 2006). Masking effects of seismic pulses are expected to be negligible in the case of the small odontocetes given the intermittent nature of seismic pulses. Dolphins and porpoises commonly are heard calling while airguns are operating (Gordon *et al.*, 2004; Smultea *et al.*, 2004; Holst *et al.*, 2005a,b). Also, the sounds important to small odontocetes are predominantly at much higher frequencies than the airgun sounds. Masking effects, in general, are discussed further in Appendix C (d) of L–DEO's application.

Disturbance Reactions

Disturbance includes a variety of effects, including subtle changes in behavior, more conspicuous changes in activities, and displacement. Reactions to sound, if any, depend on species, state of maturity, experience, current activity, reproductive state, time of day, and many other factors. If a marine mammal responds to an underwater sound by changing its behavior or moving a small distance, the response may or may not rise to the level of harassment, let alone affect the stock or the species as a whole. Alternatively, if a sound source displaces marine mammals from an important feeding or breeding area, effects on the stock or species could potentially be more than negligible. Given the many uncertainties in predicting the quantity and types of impacts of noise on marine mammals, it is common practice to estimate how many mammals are likely to be present within a particular distance of industrial activities, or exposed to a particular level of industrial sound. This practice potentially overestimates the numbers of marine mammals that are affected in some biologically-important manner.

The sound criteria used to estimate how many marine mammals might be disturbed to some biologically-important degree by a seismic program are based on behavioral observations during studies of several species. However, information is lacking for many species. Detailed studies have been done on humpback, gray, and bowhead whales and ringed seals. Less detailed data are available for some other species of baleen whales, sperm whales, small toothed whales, and sea otters.

Baleen Whales—Baleen whales generally tend to avoid operating airguns, but avoidance radii are quite variable. Whales are often reported to show no overt reactions to pulses from large arrays of airguns at distances beyond a few kilometers, even though the airgun pulses remain well above ambient noise levels out to much longer distances. However, as reviewed in Appendix C (e) of L-DEO's application, baleen whales exposed to strong noise pulses from airguns often react by deviating from their normal migration route and/or interrupting their feeding activities and moving away from the sound source. In the case of the migrating gray and bowhead whales, the observed changes in behavior appeared to be of little or no biological consequence to the animals. They simply avoided the sound source by displacing their migration route to varying degrees, but within the natural boundaries of the migration corridors.

Studies of gray, bowhead, and humpback whales have determined that received levels of pulses in the 160–170 dB re 1 μPa rms range seem to cause obvious avoidance behavior in a substantial fraction of the animals exposed. In many areas, seismic pulses from large arrays of airguns diminish to those levels at distances ranging from 4.5–14.5 km (2.8–9 mi) from the source. A substantial proportion of the baleen whales within those distances may show avoidance or other strong disturbance reactions to the airgun array. Subtle behavioral changes sometimes become evident at somewhat lower received levels, and recent studies, reviewed in Appendix C (e) of L-DEO's application, have shown that some species of baleen whales, notably bowheads and humpbacks, at times show strong avoidance at received levels lower than 160–170 dB re 1 μPa rms.

Responses of humpback whales to seismic surveys have been studied during migration and on the summer feeding grounds, and there has also been discussion of effects on the Brazilian wintering grounds. McCauley *et al.* (1998, 2000) studied the responses of humpback whales off Western Australia to a full-scale seismic survey with a 16-airgun, 2,678–in^3 array, and to a single 20-in^3 airgun with a source level of 227 dB re 1 μPa m. McCauley *et al.* (1998) documented that avoidance reactions began at 5–8 km (3.1–5 mi) from the array, and that those reactions kept most pods approximately 3–4 km (1.9–2.5 mi) from the operating seismic boat. McCauley *et al.* (2000) noted localized displacement during migration of 4–5 km (2.5–3.1 mi) by traveling pods and 7–12 km (4.3–7.5 mi) by cow-calf pairs. Avoidance distances with respect to the single airgun were smaller but consistent with the results from the full array in terms of received sound levels. Mean avoidance distance from the airgun corresponded to a received sound level of 140 dB re 1 μPa (rms); that was the level at which humpbacks started to show avoidance reactions to an approaching airgun. The standoff range, i.e., the closest point of approach of the whales to the airgun, corresponded to a received level of 143 dB re 1 μPa (rms). The initial avoidance response generally occurred at distances of 5–8 km (3.1–5 mi) from the airgun array and 2 km (1.2 mi) from the single airgun. However, some individual humpback whales, especially males, approached within distances of 100–400 m (328–1,312 ft), where the maximum received level was 179 dB re 1 μPa (rms).

Humpback whales summering in southeast Alaska did not exhibit persistent avoidance when exposed to seismic pulses from a 1.64-L (100 in^3) airgun (Malme *et al.*, 1985). Some humpbacks seemed ''startled'' at received levels of 150–169 dB re 1 μPa on an approximate rms basis. Malme *et al.* (1985) concluded that there was no clear evidence of avoidance, despite the possibility of subtle effects, at received levels up to 172 re 1 μPa (approximately rms).

Results from bowhead whales show that responsiveness of baleen whales to seismic surveys can be quite variable depending on the activity (migrating vs. feeding) of the whales. Bowhead whales migrating west across the Alaskan Beaufort Sea in autumn, in particular, are unusually responsive, with substantial avoidance occurring out to distances of 20–30 km (12.4–18.6 mi) from a medium-sized airgun source, where received sound levels were on the order of 130 dB re 1 μPa (rms) (Miller *et al.*, 1999; Richardson *et al.*, 1999). However, more recent research on bowhead whales (Miller *et al.*, 2005a) corroborates earlier evidence that, during the summer feeding season, bowheads are not as sensitive to seismic sources. In summer, bowheads typically begin to show avoidance reactions at a received level of about 160–170 dB re 1 μPa (rms) (Richardson *et al.*, 1986; Ljungblad *et al.*, 1988; Miller *et al.*, 1999). There are not data on reactions of wintering bowhead whales to seismic surveys. See Appendix C (e) of L-DEO's application for more information regarding bowhead whale reactions to airguns.

Malme *et al.* (1986, 1988) studied the responses of feeding Eastern Pacific gray whales to pulses from a single 100 in^3 airgun off St. Lawrence Island in the northern Bering Sea. Malme *et al.* (1986, 1988) estimated, based on small sample sizes, that 50 percent of feeding gray whales ceased feeding at an average received pressure level of 173 dB re 1 μPa on an (approximate) rms basis, and that 10 percent of feeding whales interrupted feeding at received levels of 163 dB. Those findings were generally consistent with the results of experiments conducted on larger numbers of gray whales that were migrating along the California coast and on observations of Western Pacific gray whales feeding off Sakhalin Island, Russia (Johnson, 2002).

We are not aware of any information on reactions of Bryde's whales to seismic surveys. However, other species of *Balaenoptera* (blue, sei, fin, and minke whales) have occasionally been reported in areas ensonified by airgun pulses. Sightings by observers on seismic vessels off the United Kingdom from 1997 to 2000 suggest that, at times of good sightability, numbers of rorquals seen are similar when airguns are shooting and not shooting (Stone, 2003). Although individual species did not show any significant displacement in relation to seismic activity, all baleen whales combined were found to remain significantly further from the airguns during shooting compared with periods without shooting (Stone, 2003; Stone and Tasker, 2006). In a study off Nova Scotia, Moulton and Miller (in press) found only a little or no difference in sighting rates and initial sighting distances of balaenopterid whales when airguns were operating vs. silent. However, there were indications that these whales were more likely to be moving away when seen during airgun operations.

Data on short-term reactions (or lack of reactions) of cetaceans to impulsive noises do not necessarily provide information about long-term effects. It is not known whether impulsive noises affect reproductive rate or distribution and habitat use in subsequent days or years. However, gray whales continued to migrate annually along the west coast of North America despite intermittent seismic exploration and much ship traffic in that area for decades (see Appendix A in Malme *et al.*, 1984). The western Pacific gray whale population did not seem affected by a seismic survey in its feeding ground during a prior year (Johnson *et al.*, 2007). Bowhead whales continued to travel to the eastern Beaufort Sea each summer despite seismic exploration in their summer and autumn range for many years (Richardson *et al.*, 1987). In any event, brief exposures to sound pulses from the proposed airgun source are highly unlikely to result in prolonged effects.

Toothed Whales—Little systematic information is available about reactions of toothed whales to noise pulses. Few studies similar to the more extensive baleen whale/seismic pulse work summarized above have been reported for toothed whales. Controlled exposure experiments on sperm whales took place in the Gulf of Mexico in 2002 and 2003 (see Miller *et al.*, 2006; Tyack *et al.*, 2006), and there is an increasing amount of information about responses of various odontocetes to seismic surveys based on monitoring studies (Stone, 2003; Smultea *et al.*, 2004; Bain and Williams, 2006; Holst *et al.*, 2006; Moulton and Miller, in press).

Seismic operators sometimes see dolphins and other small toothed whales near operating airgun arrays, but in general there seems to be a tendency for most delphinids to show some limited avoidance of seismic vessels operating large airgun systems. However, some dolphins seem to be attracted to the seismic vessel and floats, and some ride the bow wave of the seismic vessel even when large airgun arrays are firing. Nonetheless, there have been indications that small toothed whales sometimes tend to head away or to maintain a somewhat greater distance from the vessel, when a large array of airguns is operating than when it is silent (Goold, 1996a,b,c; Calambokidis and Osmek, 1998; Stone, 2003; Stone and Tasker, 2003). In most cases, the avoidance radii for delphinids appear to be small, on the order of 1 km (0.62 mi) or less. The beluga may be a species that (at least at times) shows long-distance avoidance of seismic vessels. Aerial surveys during seismic operations in the southeastern Beaufort Sea recorded much lower sighting rates of beluga whales within 10–20 km (6.2–12.4 mi) of an active seismic vessel. These results were consistent with the low number of beluga sightings reported by observers aboard the seismic vessel, suggesting that some belugas might be avoiding the seismic operations at distances of 10–20 km (6.2–12.4 mi) (Miller *et al.*, 2005a). No other odontocete is known to show avoidance at such distances.

Captive bottlenose dolphins and beluga whales exhibit changes in behavior when exposed to strong pulsed sounds similar in duration to those typically used in seismic surveys (Finneran *et al.*, 2000, 2002, 2005; Finneran and Schlundt, 2004). The animals tolerated high received levels of sound (pk-pk level >200 dB re 1 μPa) before exhibiting aversive behaviors. For pooled data at 3, 10, and 20 kHz, sound exposure levels during sessions with 25, 50, and 75 percent altered behavior were 180, 190, and 199 dB re 1 μPa^2, respectively (Finneran and Schlundt, 2004).

Results for porpoises depend on species. Dall's porpoises seem relatively tolerant of airgun operations (MacLean and Koski, 2005; Bain and Williams, 2006), whereas the limited available data suggest that harbor porpoises show stronger avoidance (Stone, 2003; Bain and Williams, 2006). This apparent difference in responsiveness of these two porpoise species is consistent with their relative responsiveness to boat traffic in general (Richardson *et al.*, 1995).

Sperm whales show considerable tolerance of airgun pulses. In most cases, the whales do not show strong avoidance and continue to call (see Appendix C of L–DEO's application). However, controlled exposure experiments in the Gulf of Mexico indicate that foraging effort is somewhat reduced upon exposure to airgun pulses from a seismic vessel operating in the area, and there may be a delay in diving to foraging depth (Miller *et al.* 2006; Tyack *et al.*, 2006).

There are no specific data on the behavioral reactions of beaked whales to seismic surveys. Most beaked whales tend to avoid approaching vessels of other types (Würsig *et al.*, 1998). They may also dive for an extended period when approached by a vessel (Kasuya, 1986). It is likely that these beaked whales would normally show strong avoidance of an approaching seismic vessel, but this has not been documented explicitly.

Odontocete reactions to large arrays of airguns are variable and, at least for delphinids and some porpoises, seem to be confined to a smaller radius than has been observed for mysticetes (Appendix C of L–DEO's application).

Pinnipeds—Pinnipeds are not likely to show a strong avoidance reaction to the airgun sources that will be used. Visual monitoring from seismic vessels, usually employing larger sources, has shown only slight (if any) avoidance of airguns by pinnipeds, and only slight (if any) changes in behavior (see Appendix C (e) of L–DEO's application). Ringed seals frequently do not avoid the area within a few hundred meters of operating airgun arrays (Harris *et al.*, 2001; Moulton and Lawson, 2002;

Miller *et al.*, 2005a). However, initial telemetry work suggests that avoidance and other behavioral reactions by two other species of seals to small airgun sources may at times be stronger than evident to date from visual studies of pinniped reactions to airguns (Thompson *et al.*, 1998). Even if reactions of any pinnipeds that might be encountered in the present study area are as strong as those evident in the telemetry study, reactions are expected to be confined to relatively small distances and durations, with no long-term effects on pinniped individuals or populations. It should be noted that pinnipeds are not likely to be encountered often, if at all, during the present study.

Additional details on the behavioral reactions (or the lack thereof) by all types of marine mammals to seismic vessels can be found in Appendix C (e) of L–DEO's application.

Hearing Impairment and Other Physical Effects

Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to very strong sounds, but there has been no specific documentation of this for marine mammals exposed to sequences of airgun pulses. Current NMFS policy regarding exposure of marine mammals to high-level sounds is that cetaceans and pinnipeds should not be exposed to impulsive sounds of 180 and 190 dB re 1 µPa (rms), respectively. Those criteria have been used in defining the safety (shut-down) radii planned for the proposed seismic survey. The precautionary nature of these criteria is discussed in Appendix C (f) of L–DEO's application, including the fact that the minimum sound level necessary to cause permanent hearing impairment is higher, by a variable and generally unknown amount, than the level that induces barely-detectable temporary threshold shift (TTS) and the level associated with the onset of TTS is often considered to be a level below which there is no danger of permanent damage. NMFS is presently developing new noise exposure criteria for marine mammals that take account of the now-available scientific data on TTS, the expected offset between the TTS and permanent threshold shift (PTS) thresholds, differences in the acoustic frequencies to which different marine mammal groups are sensitive, and other relevant factors.

Several aspects of the planned monitoring and mitigation measures for this project (see below) are designed to detect marine mammals occurring near the airguns to avoid exposing them to sound pulses that might, at least in theory, cause hearing impairment. In addition, many cetaceans are likely to show some avoidance of the area with high received levels of airgun sound (see above). In those cases, the avoidance responses of the animals themselves will reduce or (most likely) avoid any possibility of hearing impairment.

Non-auditory physical effects may also occur in marine mammals exposed to strong underwater pulsed sound. Possible types of non-auditory physiological effects or injuries that theoretically might occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage. It is possible that some marine mammal species (i.e., beaked whales) may be especially susceptible to injury and/or stranding when exposed to strong pulsed sounds. However, as discussed below, there is no definitive evidence that any of these effects occur even for marine mammals in close proximity to large arrays of airguns. It is especially unlikely that any effects of these types would occur during the present project given the brief duration of exposure of any given mammal and the planned monitoring and mitigation measures (see below). The following subsections discuss in somewhat more detail the possibilities of TTS, PTS, and non-auditory physical effects.

Temporary Threshold Shift—TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises and a sound must be stronger in order to be heard. At least in terrestrial mammals, TTS can last from minutes or hours to (in cases of strong TTS) days. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the noise ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals, and none of the published data concern TTS elicited by exposure to multiple pulses of sound.

For toothed whales exposed to single short pulses, the TTS threshold appears to be, to a first approximation, a function of the energy content of the pulse (Finneran *et al.*, 2002, 2005). Given the available data, the received level of a single seismic pulse (with no frequency weighting) might need to be approximately 186 dB re 1 $\mu Pa^2 \cdot s$ (i.e., 186 dB SEL or approximately 221–226 dB pk–pk) in order to produce brief, mild TTS. Exposure to several strong seismic pulses that each have received levels near 175–180 dB SEL might result in slight TTS in a small odontocete, assuming the TTS threshold is (to a first approximation) a function of the total received pulse energy. The distance from the *Langseth's* airguns at which the received energy level (per pulse) would be expected to be ≥175–180 dB SEL are the distances shown in the 190 dB re 1 µPa (rms) column in Table 3 of L–DEO's application and Table 1 above (given that the rms level is approximately 10–15 dB higher than the SEL value for the same pulse). Seismic pulses with received energy levels ≥175–180 dB SEL (190 dB re 1 µPa (rms)) are expected to be restricted to radii no more than 140–200 m (459–656 ft) around the airguns. The specific radius depends on the number of airguns, the depth of the water, and the tow depth of the airgun array. For an odontocete closer to the surface, the maximum radius with ≥175–180 dB SEL or ≥190 dB re 1 µPa (rms) would be smaller.

For baleen whales, direct or indirect data do not exist on levels or properties of sound that are required to induce TTS. The frequencies to which baleen whales are most sensitive are lower than those to which odontocetes are most sensitive, and natural background noise levels at those low frequencies tend to be higher. As a result, auditory thresholds of baleen whales within their frequency band of best hearing are believed to be higher (less sensitive) than are those of odontocetes at their best frequencies (Clark and Ellison, 2004). From this, it is suspected that received levels causing TTS onset may also be higher in baleen whales. In any event, no cases of TTS are expected given three considerations: (1) The relatively low abundance of baleen whales expected in the planned study areas; (2) the strong likelihood that baleen whales would avoid the approaching airguns (or vessel) before being exposed to levels high enough for there to be any possibility of TTS; and (3) the mitigation measures that are planned.

In pinnipeds, TTS thresholds associated with exposure to brief pulses (single or multiple) of underwater sound have not been measured. Initial evidence from prolonged exposures suggested that some pinnipeds may incur TTS at somewhat lower received levels than do small odontocetes exposed for similar durations, on the order of 171 dB SEL (Kastak *et al.*, 1999, 2005; Ketten *et al.*, 2001). However, pinnipeds are not expected to occur in or near the planned study areas.

A marine mammal within a radius of less than 100 m (328 ft) around a typical large array of operating airguns might be exposed to a few seismic pulses with levels of greater than or equal to 205 dB, and possibly more pulses if the mammal moved with the seismic vessel. (As noted above, most cetacean species tend to avoid operating airguns, although not all individuals do so.) In addition, ramping up airgun arrays, which is standard operational protocol for large airgun arrays, should allow cetaceans to move away form the seismic source and to avoid being exposed to the full acoustic output of the airgun array. Even with a large airgun array, it is unlikely that the cetaceans would be exposed to airgun pulses at a sufficiently high level for a sufficiently long period to cause more than mild TTS, given the relative movement of the vessel and the marine mammal. The potential for TTS is much lower in this project. With a large array of airguns, TTS would be most likely in any odontocetes that bow-ride or otherwise linger near the airguns. While bow-riding, odontocetes would be at or above the surface, and thus not exposed to strong pulses given the pressure-release effect at the surface. However, bow-riding animals generally dive below the surface intermittently. If they did so while bow-riding near airguns, they would be exposed to strong sound pulses, possibly repeatedly. If some cetaceans did incur TTS through exposure to airgun sounds, this would very likely be mild, temporary, and reversible.

To avoid injury, NMFS has determined that cetaceans and pinnipeds should not be exposed to pulsed underwater noise at received levels exceeding, respectively, 180 and 190 dB re 1 μPa (rms). As summarized above, data that are now available imply that TTS is unlikely to occur unless odontocetes (and probably mysticetes as well) are exposed to airgun pulses stronger than 180 dB re 1 μPa (rms).

Permanent Threshold Shift—When PTS occurs, there is physical damage to the sound receptors in the ear. In some cases, there can be total or partial deafness, while in other cases, the animal has an impaired ability to hear sounds in specific frequency ranges.

There is no specific evidence that exposure to pulses of airgun sound can cause PTS in any marine mammal, even with large arrays of airguns. However, given the possibility that mammals close to an airgun array might incur TTS, there has been further speculation about the possibility that some individuals occurring very close to airguns might incur PTS. Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage in terrestrial mammals. Relationships between TTS and PTS thresholds have not been studied in marine mammals, but are assumed to be similar to those in humans and other terrestrial mammals. PTS might occur at a received sound level at least several decibels above that inducing mild TTS if the animal were exposed to strong sound pulses with rapid rise time (see Appendix C (f) of L–DEO's application). The specific difference between the PTS and TTS thresholds has not been measured for marine mammals exposed to any sound type. However, based on data from terrestrial mammals, a precautionary assumption is that the PTS threshold for impulse sounds (such as airgun pulses as received close to the source) is at least 6 dB higher than the TTS threshold on a peak-pressure basis and probably more than 6 dB.

Given the higher level of sound necessary to cause PTS as compared with TTS, it is even less likely that PTS could occur. In fact, even the levels immediately adjacent to the airguns may not be sufficient to induce PTS, especially because a mammal would not be exposed to more than one strong pulse unless it swam immediately alongside the airgun for a period longer than the inter-pulse interval. Baleen whales generally avoid the immediate area around operating seismic vessels, as do some other marine mammals. The planned monitoring and mitigation measures, including visual monitoring, passive acoustic monitoring (PAM), power downs, and shut downs of the airguns when mammals are seen within the EZ will minimize the already minimal probability of exposure of marine mammals to sounds strong enough to induce PTS.

Non-auditory Physiological Effects—Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage. However, studies examining such effects are limited. If any such effects do occur, they would probably be limited to unusual situations when animals might be exposed at close range for unusually long periods. It is doubtful that any single marine mammal would be exposed to strong seismic sounds for time periods long enough to induce physiological stress.

Until recently, it was assumed that diving marine mammals are not subject to the bends or air embolism. This possibility was first explored at a workshop (Gentry [ed.], 2002) held to discuss whether the stranding of beaked whales in the Bahamas in 2000 (Balcomb and Claridge, 2001; NOAA and USN, 2001) might have been related to bubble formation in tissues caused by exposure to noise from naval sonar. However, this link could not be confirmed. Jepson *et al.* (2003) first suggested a possible link between mid-frequency sonar activity and acute chronic tissue damage that results from the formation *in vivo* of gas bubbles, based on the beaked whale stranding in the Canary Islands in 2002 during naval exercises. Fernández *et al.* (2005a) showed those beaked whales did indeed have gas bubble-associated lesions, as well as fat embolisms. Fernández *et al.* (2005b) also found evidence of fat embolism in three beaked whales that stranded 100 km (62 mi) north of the Canaries in 2004 during naval exercises. Examinations of several other stranded species have also revealed evidence of gas and fat embolisms (Arbelo *et al.*, 2005; Jepson *et al.*, 2005a; Méndez *et al.*, 2005). Most of the afflicted species were deep divers. There is speculation that gas and fat embolisms may occur if cetaceans ascend unusually quickly when exposed to aversive sounds, or if sound in the environment causes the destablization of existing bubble nuclei (Potter, 2004; Arbelo *et al.*, 2005; Fernández *et al.* 2005a; Jepson *et al.*, 2005b; Cox *et al.*, 2006). Even if gas and fat embolisms can occur during exposure to mid-frequency sonar, there is no evidence that that type of effect occurs in response to airgun sounds.

In general, little is known about the potential for seismic survey sounds to cause auditory impairment or other physical effects in marine mammals. The available data do not allow for meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in those ways. Marine mammals that show behavioral avoidance of seismic vessels, including most baleen whales, some odontocetes, and some pinnipeds, are especially unlikely to incur auditory impairment or other physical effects. It is not known whether aversive behavioral responses to airgun pulses by deep-diving species could lead to indirect physiological problems as apparently can occur upon exposure of some beaked whales to mid-frequency sonar (Cox *et al.*, 2006). Also, the planned mitigation measures, including shut downs of the airguns, will reduce any such effects that might otherwise occur.

Strandings and Mortality

Marine mammals close to underwater detonations of high explosives can be killed or severely injured, and their auditory organs are especially susceptible to injury (Ketten *et al.*, 1993;

Ketten 1995). Airgun pulses are less energetic and have slower rise times, and there is no proof that they can cause serious injury, death, or stranding even in the case of large airgun arrays. However, the association of mass strandings of beaked whales with naval exercises (see Appendix C of L–DEO's application) and, in one case, an L–DEO seismic survey, has raised the possibility that beaked whales exposed to strong pulsed sounds may be especially susceptible to injury and/or behavioral reactions that can lead to stranding.

Seismic pulses and mid-frequency sonar pulses are quite different. Sounds produced by airgun arrays are broadband with most of the energy below 1 kHz. Typical military mid-frequency sonars operate at frequencies of 2–10 kHz, generally with a relatively narrow bandwidth at any one time. Thus, it is not appropriate to assume that there is a direct connection between the effects of military sonar and seismic surveys on marine mammals. However, evidence that sonar pulses can, in special circumstances, lead to physical damage and mortality (Balcomb and Claridge, 2001; NOAA and USN, 2001; Jepson *et al.*, 2003; Fernández *et al.*, 2004, 2005a; Cox *et al.*, 2006), even if only indirectly, suggests that caution is warranted when dealing with exposure of marine mammals to any high-intensity pulsed sound.

There is no conclusive evidence of cetacean strandings as a result of exposure to seismic surveys. Speculation concerning a possible link between seismic surveys and strandings of humpback whales in Brazil (Engel *et al.*, 2004) was not well founded based on available data (IAGC, 2004; IWC, 2006). In September 2002, there was a stranding of two Cuvier's beaked whales in the Gulf of California, Mexico, when the L–DEO vessel *Ewing* was operating a 20-gun, 8,490-in^3 array in the general area. The link between the stranding and the seismic survey was inconclusive and not based on any physical evidence (Hogarth, 2002; Yoder, 2002). Yet, the preceding example plus the incidents involving beaked whale strandings near naval exercises suggests a need for caution in conducting seismic surveys in areas occupied by beaked whales. No injuries of beaked whales are anticipated during the proposed study because of the proposed monitoring and mitigating measures.

Potential Effects of Other Acoustic Devices

Multibeam Echosounder Signals

The Kongsberg Simrad EM 120 12-kHz MBES will be operated from the source vessel at some times during the planned study. Sounds from the MBES are very short pulses, occurring for 15 ms once every 5–20 s, depending on water depth. Most of the energy in the sound pulses emitted by the MBES is at frequencies centered at 12 kHz. The beam is narrow (1°) in fore-aft extent and wide (150°) in the cross-track extent. Each ping consists of nine successive fan-shaped transmissions (segments) at different cross-track angles. Any given mammal at depth near the trackline would be in the main beam for only one or two of the nine segments. Also, marine mammals that encounter the MBES are unlikely to be subjected to repeated pulses because of the narrow fore-aft width of the beam and will receive only limited amounts of pulse energy because of the short pulses. Animals close to the ship (where the beam is narrowest) are especially unlikely to be ensonified for more than one 15 ms pulse (or two pulses if in the overlap area). Similarly, Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when an MBES emits a pulse is small. The animal would have to pass the transducer at close range and be swimming at speeds similar to the vessel in order to be subjected to sound levels that could cause TTS.

Marine mammal communications will not be masked appreciably by the MBES signals given its low duty cycle and the brief period when an individual mammal is likely to be within its beam. Furthermore, in the case of baleen whales, the signals (12 kHz) do not overlap with the predominant frequencies in the calls, which would avoid significant masking.

Behavioral reactions of free-ranging marine mammals to sonars and other sound sources appear to vary by species and circumstance. Observed reactions have included silencing and dispersal by sperm whales (Watkins *et al.*, 1985), increased vocalizations and no dispersal by pilot whales (Rendell and Gordon, 1999), and the previously-mentioned beachings by beaked whales. During exposure to a 21–25 kHz whale-finding sonar with a source level of 215 dB re 1 μPa, gray whales showed slight avoidance (approximately 200 m; 656 ft) behavior (Frankel, 2005). However, all of those observations are of limited relevance to the present situation. Pulse durations from those sonars were much longer than those of the MBES, and a given mammal would have received many pulses from the naval sonars. During L-DEO's operations, the individual pulses will be very short, and a given mammal would not receive many of the downward-directed pulses as the vessel passes by.

Captive bottlenose dolphins and a white whale exhibited changes in behavior when exposed to 1 s pulsed sounds at frequencies similar to those that will be emitted by the MBES used by L-DEO and to shorter broadband pulsed signals. Behavioral changes typically involved what appeared to be deliberate attempts to avoid the sound exposure (Schlundt *et al.*, 2000; Finneran *et al.*, 2002; Finneran and Schlundt, 2004). The relevance of those data to free-ranging odontocetes is uncertain, and in any case, the test sounds were quite different in either duration or bandwidth as compared with those from an MBES.

We are not aware of any data on the reactions of pinnipeds to sonar or echosounder sounds at frequencies similar to the 12 kHz frequency of the *Langseth's* MBES. Based on observed pinniped responses to other types of pulsed sounds, and the likely brevity of exposure to the MBES sounds, pinniped reactions are expected to be limited to startle or otherwise brief responses of no lasting consequence to the animals. Also, few if any pinnipeds will be encountered during this project.

NMFS believes that the brief exposure of marine mammals to one pulse, or small numbers of signals, from the MBES are not likely to result in the harassment of marine mammals.

Sub-Bottom Profiler Signals

An SBP will be operated from the source vessel during the planned study. Sounds from the SBP are very short pulses, occurring for 1, 2, or 4 ms once every second. Most of the energy in the sound pulses emitted by the SBP is at mid frequencies, centered at 3.5 kHz. The beamwidth is approximately 30° and is directed downward.

Sound levels have not been measured directly for the SBP used by the *Langseth*, but Burgess and Lawson (2000) measured sounds propagating more or less horizontally from a similar unit with similar source output (205 dB re 1 μPa at 1 m). The 160 and 180 dB re 1 μPa (rms) radii, in the horizontal direction, were estimated to be, respectively, near 20 m (66 ft) and 8 m (26 ft) from the source, as measured in 13 m (42.7 ft) water depth. The corresponding distances for an animal in the beam below the transducer would be greater, on the order of 180 m (590.6

ft) and 18 m (59 ft), assuming spherical spreading.

The SBP on the *Langseth* has a stated maximum source level of 204 dB re 1 µPa at 1 m. Thus, the received level would be expected to decrease to 160 and 180 dB about 160 m (525 ft) and 16 m (52.5 ft) below the transducer, respectively, again assuming spherical spreading. Corresponding distances in the horizontal plane would be lower, given the directionality of this source (30° beam width) and the measurements of Burgess and Lawson (2000).

Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when the SBP emits a pulse is small, and if the animal was in the area, it would have to pass the transducer at close range in order to be subjected to sound levels that could cause TTS.

Marine mammal communications will not be masked appreciably by the SBP signals given their directionality and the brief period when an individual mammal is likely to be within its beam. Furthermore, in the case of most odontocetes, the signals do not overlap with the predominant frequencies in the calls, which would avoid significant masking.

Marine mammal behavioral reactions to other pulsed sound sources are discussed above, and responses to the SBP are likely to be similar to those for other pulsed sources if received at the same levels. The pulsed signals from the SBP are somewhat weaker than those from the MBES. Therefore, behavioral responses are not expected unless marine mammals are very close to the source (e.g., about 160 m, 525 ft, below the vessel or a lesser distance to the side).

Source levels of the SBP are much lower than those of the airguns and the MBES, which are discussed above. Sounds from the SBP are estimated to decrease to 180 dB re 1 µPa (rms) at 8 m (26 ft) horizontally from the source (Burgess and Lawson, 2000) and at approximately 18 m (59 ft) downward from the source. Furthermore, received levels of pulsed sounds that are necessary to cause temporary or especially permanent hearing impairment in marine mammals appear to be higher than 180 dB (see earlier). Thus, it is unlikely that the SBP produces pulse levels strong enough to cause hearing impairment or other physical injuries even in an animal that is (briefly) in a position near the source.

The SBP is usually operated simultaneously with other higher-power acoustic sources. Many marine mammals will move away in response to the approaching higher-power sources or the vessel itself before the mammals would be close enough for there to be any possibility of effects from the less intense sounds from the SBP. In the case of mammals that do not avoid the approaching vessel and its various sound sources, mitigation measures that would be applied to minimize effects of other sources would further reduce or eliminate any minor effects of the SBP.

Estimated Take by Incidental Harassment

All anticipated takes would be ''takes by harassment'', involving temporary changes in behavior. The proposed mitigation measures are expected to minimize the possibility of injurious takes. (However, as noted earlier, there is no specific information demonstrating that injurious ''takes'' would occur even in the absence of the planned mitigation measures.) The sections below describe methods to estimate ''take by harassment'', and present estimates of the numbers of marine mammals that might be affected during the proposed Central American SubFac seismic program. The estimates of ''take by harassment'' are based on consideration of the number of marine mammals that might be disturbed appreciably by approximately 1,328 km of seismic surveys in the western Caribbean and 2,652 km in the eastern Pacific. The main sources of distributional and numerical data used in deriving the estimates are described below.

The anticipated radii of influence of the MBES and the SBP are less than those for the airgun array. It is assumed that, during simultaneous operations of the airgun array and echosounders, marine mammals close enough to be affected by the echosounders would already be affected by the airguns. However, whether or not the airguns are operating simultaneously with the echosounders, marine mammals are expected to exhibit no more than short-term and inconsequential responses to the echosounders given their characteristics (e.g., narrow downward-directed beam) and other considerations described above. NMFS believes that such reactions are not considered to constitute ''taking.'' Therefore, no additional allowance is included for animals that might be affected by sound sources other than airguns.

Extensive marine mammal surveys have been conducted in the ETP over numerous years (e.g., Polacheck, 1987; Wade and Gerrodette, 1993; Kinsey *et al.*, 1999, 2000, 2001; Ferguson and Barlow, 2001; Smultea and Holst, 2003; Jackson *et al.*, 2004; Holst *et al.*, 2005a; May-Collado *et al.*, 2005). Therefore, for the Pacific portion of the proposed seismic survey, marine mammal density data were readily available. The most comprehensive data available for the region encompassing the proposed survey area are from Ferguson and Barlow (2001) and Holst *et al.* (2005a). The Ferguson and Barlow (2001) surveys took place from late July to early December across a large area of the ETP. For density estimates in this project, L–DEO only used data from areas in or adjacent to the proposed study location. These areas included ten 5° x 5° survey blocks from the Ferguson and Barlow (2001) surveys: 118, 119, 137, 138, 139, 140, 158, 159, 160, and 161. These blocks included survey effort in all water depths, but primarily deeper than 100 m (328 ft). Similarly, survey data from all water depths were included from Holst *et al.* (2005a), although most effort (more than 93 percent) occurred in water more than 100 m (328 ft) deep. Survey data collected by Holst *et al.* (2005a) were the result of a marine mammal monitoring and mitigation program during L–DEO's seismic survey off Costa Rica and Nicaragua in November–December, 2004. Only data collected during non-seismic periods were combined with data from Ferguson and Barlow (2001) to calculate mean densities for the proposed study area. However, data collected by Holst *et al.* (2005a) during seismic and non-seismic periods were used to estimate allowances for sightings identified to species.

The proposed survey off the Pacific coast of Central America is presently scheduled to occur in the February–April period. Therefore, the representativeness of the data collected by Holst *et al.* (2005a) in November–December and especially by Ferguson and Barlow (2001) in July–December is uncertain. For some species, the densities derived from past surveys may not be representative of the densities that will be encountered during the proposed seismic study. As an example of potential uncertainty of the data, the number of cetaceans sighted during L–DEO's 2003 Hess Deep seismic operations (see Smultea and Holst, 2003) was considerably lower (only one sighting) than expected based on the Ferguson and Barlow (2001) data. The Hess Deep Survey occurred in mid-July and was apparently not well represented by the Ferguson and Barlow (2001) data collected largely during the autumn in other years. Similarly, the densities calculated by Holst *et al.* (2005a) were generally lower for dolphins and greater for humpbacks compared with those determined by Ferguson and Barlow (2001).

Despite the above caveats, the Ferguson and Barlow (2001) and Holst *et al.* (2005a) data still represent the best available data for estimating numbers of marine mammals potentially exposed to the proposed seismic sounds. Table 6 of L–DEO's application shows the densities that were derived from Ferguson and Barlow (2001) and Holst *et al.* (2005a), which were used to estimate numbers of marine mammals potentially exposed. The densities reported by Ferguson and Barlow (2001) and Holst *et al.* (2005a) were corrected for both detectability [f(0)] and availability [g(0)] biases, and therefore, are relatively unbiased. To provide some allowances for uncertainties in these data, ''best estimates'' and ''maximum estimates'' of the numbers potentially affected have been derived (see Table 7 in the application).

For the Caribbean portion of the Central American SubFac program, we were unable to find published data on marine mammal densities in or immediately adjacent to the proposed seismic survey area. The closest quantitative surveys were conducted in the southeast Caribbean (Swartz and Burks, 2000; Swartz *et al.*, 2001; Smultea *et al.*, 2004). Most of the survey effort by Swartz and Burks (2000) and Swartz *et al.* (2001) took place during March and April near the islands on the east side of the Caribbean Sea and near the north and northeast coasts of Venezuela in water depths <1,000 m. Survey data from Smultea *et al.* (2004) were collected north of Venezuela during April–June in association with a previous L–DEO seismic survey. The proposed survey is scheduled to occur sometime in February to early April in the western Caribbean Sea, a location and time of year in which the species densities are likely different from those during the above-mentioned surveys in the southeast Caribbean. Therefore, the representativeness of the data is uncertain, but they are the best available at this time.

The data from Smultea *et al.* (2004) were deemed to be more representative of the proposed study area than those from Swartz and Burks (2000) and Swartz *et al.* (2001) because Smultea *et al.* (2004) reported separate densities for different water depth categories, whereas the other surveys did not.

However, there was no shallow-water effort during surveys by Smultea *et al.* (2004). Densities from a survey off Yucatán, Mexico (Holst *et al.*, 2005b), were used for shallow water, as those data were deemed more appropriate than densities for deeper waters from the southeast Caribbean surveys. Therefore, for the Central American SubFac survey, mean densities for intermediate and deep water are those for non-seismic periods from Smultea *et al.* (2004), and for shallow water, densities for non-seismic periods from Holst *et al.* (2005b) were used (see Table 8 in L–DEO's application). Densities were available for striped, Atlantic spotted, and bottlenose dolphins, as well as for short-finned pilot whales, and were corrected for detectability [f(0)] and availability [g(0)] biases and for unidentified sightings by the original authors. To allow for the possibility of encountering small numbers of individuals of other species in the survey area, even though they were not recorded during previous surveys, L–DEO adjusted the 'maximum estimates' based on mean group size, if available (e.g., Swartz and Burks, 2000).

The number of different individuals that may be exposed to airgun sounds with received levels ≥160 dB re 1 µPa (rms) on one or more occasions can be estimated by considering the total marine area that would be within the 160–dB radius around the operating airgun array on at least one occasion. Most of the proposed lines (9 of 11) will be surveyed twice, although it is unknown how much time will pass between the first and second transit along each line. Therefore, some of the same individuals may be approached by the operating airguns and come within the 160–dB distance on two occasions. However, this also means that some different marine mammals could occur in the area during the second pass. Thus, the best estimates in this section are based on a single pass of all survey lines (including a 15 percent contingency for airgun operations during turns), and maximum estimates are based on maximum estimates (i.e., for the Pacific) or on at least two times the best estimate. Table 8 in L–DEO's application shows the best and maximum estimates of the number of marine mammals that could potentially be affected during the Caribbean portion of the seismic survey.

The potential number of different individuals that might be exposed to received levels ≥160 dB re 1 µPa (rms) was calculated separately for the Pacific and Caribbean study areas. For the Caribbean portion of the Central American SubFac survey, the number of potentially-affected individuals was calculated for each of three water depth categories (shallow, <100 m or <328 ft; intermediate-depth, 100–1,000 m or 328–3,280 ft; and deep, >1,000 m or 3,280 ft). However, for the Pacific area, no distinction was made between different water depth categories for several reasons: (1) Less than five percent of the proposed survey in the Pacific will take place in water <100 m (328 ft) deep; (2) most of the effort (>93 percent) during surveys by Holst *et al.* (2005a) took place in waters deeper than 100 m (328 ft); and (3) Ferguson and Barlow (2001) did not present depth-specific densities.

The number of different individuals potentially exposed to received levels *160 dB re 1 µPa (rms) was calculated by multiplying:

The expected species density, either ''mean'' (i.e., best estimate) or ''maximum'', for a particular water depth, times

The anticipated minimum area to be ensonified to that level during airgun operations in each water depth category. The 160–dB re 1 µPa (rms) distances were as predicted by L–DEO's model, with adjustments based on Tolstoy *et al.* (2004a,b) for shallow and intermediate-depth water.

The area expected to be ensonified was determined by entering the planned survey lines into a MapInfo Geographic Information System (GIS), using the GIS to identify the relevant areas by ''drawing'' the applicable 160–dB buffer around each seismic line (depending on water and tow depth) and then calculating the total area within the buffers. Areas where overlap occurred were included only once to determine the minimum area expected to be ensonified to ≥160 dB at least once.

Applying the approach described above, approximately 19,193 km^2 would be within the 160–dB isopleth on one or more occasions during the Pacific portion of the survey, and 12,643 km^2 would be ensonified on one or more occasions during the Caribbean portion of the survey. However, this approach does not allow for turnover in the mammal populations in the study area during the course of the studies. This might somewhat underestimate actual numbers of individuals exposed, although the conservative distances used to calculate the area may offset the underestimate. In addition, the approach assumes that no cetaceans will move away or toward the trackline as the *Langseth* approaches in response to increasing sound levels prior to the time the levels reach 160 dB re 1 µPa (rms). Another way of interpreting the estimates that follow is that they represent the number of individuals that are expected (in the absence of a seismic program) to occur in the waters that will be exposed to *160 dB re 1 µPa (rms).

The 'best estimate' of the number of individual marine mammals that might be exposed to seismic sounds with received levels ≥160 dB re 1 μPa (rms) during the Pacific portion of the proposed survey is 15,572 (Table 7 in L–DEO's application). That total includes 79 endangered whales (71 sperm, 4 humpback, and 4 blue whales), 156 beaked whales, and 21 Bryde's whale (Table 7 in the application). Striped, short-beaked common, and pantropical spotted dolphins are expected to be the most common species in the Pacific part of the study area. The best estimates for those species are 4,005, 3,931, and 2,952, respectively (Table 7). Estimates for other species are lower (Table 7). The 'maximum estimate' for the Pacific is 52,438 individual marine mammals. Most of these would be dolphins (Table 7). The maximum estimate of 101 humpback whales is likely a more realistic estimate of the number of individuals that might be exposed to seismic sound levels ≥160 dB re 1 μPa (rms) during the Pacific survey, as these estimates are based on density data from July–December and not from the peak breeding/calving period in January–March. The numbers for which take authorization is requested, given in the far right column in Table 7 of L–DEO's application and Table 2 here, are the maximum estimates. Since the take estimates proposed in this document fall largely within 3 percent (all but dwarf sperm (7.64 percent) and humpback (7.26 percent) whales) of the numbers estimated to be present during a localized survey in the Pacific Ocean off the coasts of Costa Rica and Nicaragua, and the species range far beyond the Pacific Ocean (i.e., the abundance of the species is notably larger), NMFS believes that the estimated take numbers for these species are small relative both to the worldwide abundance of these species and to numbers taken in other activities that have been authorized for incidental take of these species.

The 'best estimate' of the number of individual marine mammals that might be exposed to seismic sounds with received levels ≥160 dB re 1 μPa (rms) during the Caribbean portion of the proposed survey is 461 (Table 8 in L–DEO's application). That total includes five endangered whales (three sperm, one humpback, and one fin whale), two beaked whales, and two Bryde's whale (Table 8 in the application). Atlantic spotted and bottlenose dolphins are expected to be the most common species in the Caribbean part of the study area; the best estimates for those species are 220 and 194, respectively (Table 8). Estimates for other species are lower (Table 8). The maximum estimate for the Caribbean is 998 individual marine mammals. The numbers for which take authorization is requested, given in the far right column in Table 8 of L–DEO's application and Table 2 here, are the maximum estimates. Since the take estimates proposed in this document are less than 1 percent (all but killer (7.52 percent) and Bryde's (8.57 percent) whales) of the numbers estimated to be present during a localized survey in the Caribbean Sea off the coasts of Costa Rica and Nicaragua, and the species range far beyond the Caribbean (i.e., the abundance of the species is notably larger), NMFS believes that the estimated take numbers for these species are small relative both to the worldwide abundance of these species and to numbers taken in other activities that have been authorized for incidental take of these species.

No pinnipeds are expected to be encountered in the Caribbean, and the likelihood of encountering sea lions or other pinnipeds in the Pacific study area is also very low. No take of any pinniped species is requested.

Potential Effects on Habitat

The proposed seismic surveys will not result in any permanent impact on habitats used by marine mammals or to the food sources they use. The main impact issue associated with the proposed activity will be temporarily elevated noise levels and the associated direct effects on marine mammals, as discussed above. The following sections briefly review effects of airguns on fish and invertebrates, and more details are included in Appendices D and E, respectively, in L–DEO's application.

One of the reasons for the adoption of airguns as the standard energy source for marine seismic surveys was that, unlike explosives, they have not been associated with large-scale fish kills. However, the existing body of information relating to the impacts of seismic surveys on marine fish (see Appendix D of L–DEO's application) and invertebrate species (Appendix E of the application) is very limited. The various types of potential effects of exposure to seismic on fish and invertebrates can be considered in three categories: (1) Pathological, (2) physiological, and (3) behavioral. Pathological effects include lethal and sub-lethal damage to the animals, physiological effects include temporary primary and secondary stress responses, and behavioral effects refer to changes in exhibited behavior of the fish and invertebrates. The three categories are interrelated in complex ways. For example, it is possible that certain physiological and behavioral changes could potentially lead to the ultimate pathological effect on individual animals (i.e., mortality).

Available information on the impacts of seismic surveys on marine fish and invertebrates is from studies of individuals or portions of a population; there have been no studies conducted at the population level. Thus, available information provides limited insight on possible real-world effects at the ocean or population scale. This makes drawing conclusions about impacts on fish and invertebrates problematic because ultimately, the most important aspect of potential impacts relates to how exposure to seismic survey sound affects marine fish and invertebrate populations and their viability, including their availability to fisheries.

The following sections provide an overview of the information that exists on the effects of exposure to seismic and other anthropogenic sounds on fish and invertebrates. The information comprises results from scientific studies of varying degrees of soundness and some anecdotal information.

Pathological Effects—Wardle *et al.* (2001) suggested that in water, acute injury and death of organisms exposed to seismic energy depends primarily on two features of the sound source: (1) the received peak pressure and (2) the time required for the pressure to rise and decay. Generally, as received pressure increases, the period for the pressure to rise and decay decreases, and the chance of acute pathological effects increases. According to Buchanan *et al.* (2004), for the types of seismic airguns and arrays involved with the proposed program, the pathological (mortality) zone for fish and invertebrates would be expected to be within a few meters of the seismic source. Numerous other studies provide examples of no fish mortality upon exposure to seismic sources (Falk and Lawrence, 1973; Holliday *et al.*, 1987; La Bella *et al.*, 1996; Santulli *et al.*, 1999; McCauley *et al.*, 2000a,b, 2003; Bjarti, 2002; Hassel *et al.*, 2003; Popper *et al.*, 2005).

The potential for pathological damage to hearing structures in fish depends on the energy level of the received sound and the physiology and hearing capability of the species in question (see Appendix D of L–DEO's application). For a given sound to result in hearing loss, the sound must exceed, by some specific amount, the hearing threshold of the fish for that sound (Popper *et al.*, 2005). The consequences of temporary or permanent hearing loss in individual fish on a fish population is unknown; however, it likely depends on the number of individuals affected and whether critical behaviors involving sound (e.g., predator avoidance, prey capture, orientation and navigation, reproduction, etc.) are adversely affected.

Little is known about the mechanisms and characteristics of damage to fish that may be inflicted by exposure to seismic survey sounds. Few data have been presented in the peer-reviewed scientific literature. There are two valid papers with proper experimental methods, controls, and careful pathological investigation implicating sounds produced by actual seismic survey airguns with adverse anatomical effects. One such study indicated anatomical damage and the second indicated TTS in fish hearing. McCauley *et al.* (2003) found that exposure to airgun sound caused observable anatomical damage to the auditory maculae of ''pink snapper'' (*Pagrus auratus*). This damage in the ears had not been repaired in fish sacrificed and examined almost two months after exposure. On the other hand, Popper *et al.* (2005) documented only TTS (as determined by auditory brainstem response) in two of three fishes from the Mackenzie River Delta. This study found that broad whitefish (*Coreogonus nasus*) that received a sound exposure level of 177 dB re 1 $\mu Pa^2 \cdot s$ showed no hearing loss. During both studies, the repetitive exposure to sound was greater than would have occurred during a typical seismic survey. However, the substantial low-frequency energy produced by the airgun arrays [less than approximately 400 Hz in the study by McCauley *et al.* (2003) and less than approximately 200 Hz in Popper *et al.* (2005)] likely did not propagate to the fish because the water in the study areas was very shallow (approximately 9 m, 29.5 ft, in the former case and <2 m, 6.6 ft, in the latter). Water depth sets a lower limit on the lowest sound frequency that will propagate (the ''cutoff frequency'') at about one-quarter wavelength (Urick, 1983; Rogers and Cox, 1988). Except for these two studies, at least with airgun-generated sound treatments, most contributions rely on rather subjective assays such as fish ''alarm'' or ''startle response'' or changes in catch rates by fishers. These observations are important in that they attempt to use the levels of exposures that are likely to be encountered by most free-ranging fish in actual survey areas. However, the associated sound stimuli are often poorly described, and the biological assays are varied (Hastings and Popper, 2005).

Some studies have reported that mortality of fish, fish eggs, or larvae can occur close to seismic sources (Kostyuchenko, 1973; Dalen and Knutsen, 1986; Booman *et al.*, 1996; Dalen *et al.*, 1996). Some of the reports claimed seismic effects from treatments quite different from actual seismic survey sounds or even reasonable surrogates. Saetre and Ona (1996) applied a 'worst-case scenario' mathematical model to investigate the effects of seismic energy on fish eggs and larvae and concluded that mortality rates caused by exposure to seismic are so low, as compared to natural mortality rates, that the impact of seismic surveying on recruitment to a fish stock must be regarded as insignificant.

Some studies have suggested that seismic survey sound has a limited pathological impact on early developmental stages of crustaceans (Pearson *et al.*, 1994; Christian *et al.*, 2003; DFO, 2004). However, the impacts appear to be either temporary or insignificant compared to what occurs under natural conditions. Controlled field experiments on adult crustaceans (Christian *et al.*, 2003, 2004; DFO, 2004) and adult cephalopods (McCauley *et al.*, 2000a,b) exposed to seismic survey sound have not resulted in any significant pathological impacts on the animals. It has been suggested that exposure to commercial seismic survey activities has injured giant squid (Guerra *et al.*, 2004), but there is no evidence to support such claims.

Physiological Effects—Physiological effects refer to cellular and/or biochemical responses of fish and invertebrates to acoustic stress. Such stress potentially could affect fish and invertebrate populations by increasing mortality or reducing reproductive success. Primary and secondary stress responses (i.e., changes in haemolymph levels of enzymes, proteins, etc.) of crustaceans or fish after exposure to seismic survey sounds appear to be temporary (hours to days) in studies done to date (see Payne *et al.*, 2007 for invertebrates; see Sverdrup *et al.*, 1994; McCauley *et al.*, 2000a,b for fish). The periods necessary for these biochemical changes to return to normal are variable and depend on numerous aspects of the biology of the species and of the sound stimulus.

Summary of Physical (Pathological and Physiological) Effects—As indicated in the preceding general discussion, there is a relative lack of knowledge about the potential physical (pathological and physiological) effects of seismic energy on marine fish and invertebrates. Available data suggest that there may be physical impacts on egg, larval, juvenile, and adult stages at very close range. Considering typical source levels associated with commercial seismic arrays, close proximity to the source would result in exposure to very high energy levels. Whereas egg and larval stages are not able to escape such exposures, juveniles and adults most likely would avoid it. In the case of eggs and larvae, it is likely that the numbers adversely affected by such exposure would not be that different from those succumbing to natural mortality. Limited data regarding physiological impacts on fish and invertebrates indicate that these impacts are short term and are most apparent after exposure at close range.

The proposed seismic program for 2008 is predicted to have negligible to low physical effects on the various life stages of fish and invertebrates for its short duration (approximately 25 days each in the Pacific Ocean and Caribbean Sea) and approximately 2,149-km of unique survey lines extent. Therefore, physical effects of the proposed program on fish and invertebrates would not be significant.

Behavioral Effects—Because of the apparent lack of serious pathological and physiological effects of seismic energy on marine fish and invertebrates, the highest level of concern now centers on the possible effects of exposure to seismic surveys on the distribution, migration patterns, mating, and catchability of fish. There is a need for more information on exactly what effects such sound sources might have on the detailed behavior patterns of fish and invertebrates at different ranges.

Studies investigating the possible effects of seismic energy on fish and invertebrate behavior have been conducted on both uncaged and caged animals (Chapman and Hawkins, 1969; Pearson *et al.*, 1992; Santulli *et al.*, 1999; Wardle *et al.*, 2001; Hassel *et al.*, 2003). Typically, in these studies fish exhibited a sharp ''startle'' response at the onset of a sound followed by habituation and a return to normal behavior after the sound ceased.

There is general concern about potential adverse effects of seismic operations on fisheries, namely a potential reduction in the ''catchability'' of fish involved in fisheries. Although reduced catch rates have been observed in some marine fisheries during seismic testing, in a number of cases the findings are confounded by other sources of disturbance (Dalen and Raknes, 1985; Dalen and Knutsen, 1986; Lφokkeborg, 1991; Skalski *et al.*, 1992; Enges *et al.*, 1996). In other airgun experiments, there was no change in catch per unit effort (CPUE) of fish when airgun pulses were emitted, particularly in the immediate vicinity of the seismic survey (Pickett *et al.*, 1994; La Bella *et al.*, 1996). For some species, reductions in catch may have resulted from a change in behavior of the fish (e.g., a change in vertical or horizontal distribution) as reported in Slotte *et al.* (2004).

In general, any adverse effects on fish behavior or fisheries attributable to seismic testing may depend on the species in question and the nature of the fishery (season, duration, fishing method). They may also depend on the age of the fish, its motivational state, its size, and numerous other factors that are difficult, if not impossible, to quantify at this point, given such limited data on effects of airguns on fish, particularly under realistic at-sea conditions.

For marine invertebrates, behavioral changes could potentially affect such aspects as reproductive success, distribution, susceptibility to predation, and catchability by fisheries. Studies of squid indicated startle responses (McCauley *et al.*, 2000a,b). In other cases, no behavioral impacts were noted (*e.g.*, crustaceans in Christian *et al.*, 2003, 2004; DFO, 2004). There have been anecdotal reports of reduced catch rates of shrimp shortly after exposure to seismic surveys; however, other studies have not observed any significant changes in shrimp catch rate (Andriguetto-Filho *et al.*, 2005). Parry and Gason (2006) reported no changes in rock lobster CPUE during or after seismic surveys off western Victoria, Australia, from 1978–2004. Any adverse effects on crustacean and cephalopod behavior or fisheries attributable to seismic survey sound depend on the species in question and the nature of the fishery (season, duration, fishing method). Additional information regarding the behavioral effects of seismic on invertebrates is contained in Appendix E (c) of L–DEO's application.

Summary of Behavioral Effects—is the case with pathological and physiological effects of seismic on fish and invertebrates, available information is relatively scant and often contradictory. There have been well-documented observations of fish and invertebrates exhibiting behaviors that appeared to be responses to exposure to seismic energy (i.e., startle response, change in swimming direction and speed, and change in vertical distribution), but the ultimate importance of those behaviors is unclear. Some studies indicate that such behavioral changes are very temporary, whereas others imply that fish might not resume pre-seismic behaviors or distributions for a number of days. There appears to be a great deal of inter- and intra-specific variability. In the case of finfish, three general types of behavioral responses have been identified: startle, alarm, and avoidance. The type of behavioral reaction appears to depend on many factors, including the type of behavior being exhibited before exposure, and proximity and energy level of sound source.

During the proposed study, only a small fraction of the available habitat would be ensonified at any given time, and fish species would return to their pre-disturbance behavior once the seismic activity ceased. The proposed seismic program is predicted to have negligible to low behavioral effects on the various life stages of the fish and invertebrates during its relatively short duration and extent.

Because of the reasons noted above and the nature of the proposed activities, the proposed operations are not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals or their populations or stocks. Similarly, any effects to food sources are expected to be negligible.

Monitoring

Vessel-based Visual Monitoring

Vessel-based marine mammal visual observers (MMVOs) will be based aboard the seismic source vessel and will watch for marine mammals near the vessel during daytime airgun operations and during start-ups of airguns at night. MMVOs will also watch for marine mammals near the seismic vessel for at least 30 minutes prior to the start of airgun operations after an extended shutdown of the airguns. When feasible, MMVOs will also make observations during daytime periods when the seismic system is not operating for comparison of animal abundance and behavior. Based on MMVO observations, airguns will be powered down, or if necessary, shut down completely (see below), when marine mammals are detected within or about to enter a designated EZ (safety radius). The MMVOs will continue to maintain watch to determine when the animal(s) are outside the EZ, and airgun operations will not resume until the animal has left that zone. The EZ is a region in which a possibility exists of adverse effects on animal hearing or other physical effects.

During seismic operations off Central America, at least three observers will be based aboard the *Langseth*. MMVOs will be appointed by L–DEO with NMFS concurrence. At least one MMVO, and when practical two, will monitor the EZ for marine mammals during daytime operations and nighttime startups of the airguns. MMVO(s) will be on duty in shifts of duration no longer than 4 hours. The crew will also be instructed to assist in detecting marine mammals and implementing mitigation requirements (if practical).

The *Langseth* is a suitable platform for marine mammal observations. When stationed on the observation platform, the eye level will be approximately 17.8 m (58.4 ft) above sea level, and the observer will have a good view around the entire vessel. During daytime, the MMVO(s) will scan the area around the vessel systematically with reticle binoculars (e.g., 7×50 Fujinon), Big-eye binoculars (25×150), and with the naked eye. During darkness, night vision devices will be available (ITT F500 Series Generation 3 binocular-image intensifier or equivalent). Laser rangefinding binoculars (Leica LRF 1200 laser rangefinder or equivalent) will be available to assist with distance estimation.

Passive Acoustic Monitoring

PAM will take place to complement the visual monitoring program. Visual monitoring typically is not effective during periods of bad weather or at night, and even with good visibility, is unable to detect marine mammals when they are below the surface or beyond visual range. Acoustic monitoring can be used in addition to visual observations to improve detection, identification, localization, and tracking of cetaceans. It is only useful when marine mammals call, but it can be effective either by day or by night and does not depend on good visibility. The acoustic monitoring will serve to alert visual observers (if on duty) when vocalizing cetaceans are detected. It will be monitored in real time so visual observers can be advised when cetaceans are detected. When bearings (primary and mirror-image) to calling cetacean(s) are determined, the bearings will be relayed to the visual observer to help him/her sight the calling animal(s).

SEAMAP (Houston, Texas) will be used as the primary acoustic monitoring system. This system was also used during several previous L–DEO seismic cruises (e.g., Smultea *et al.*, 2004, 2005; Holst *et al.*, 2005a,b). The PAM system consists of hardware (*i.e.*, hydrophones) and software. The ''wet end'' of the SEAMAP system consists of a low-noise, towed hydrophone array that is connected to the vessel by a ''hairy'' faired cable. The array will be deployed from a winch located on the back deck. A deck cable will connect form the winch to the main computer lab where the acoustic station and signal conditioning and processing system will be located. The lead-in from the hydrophone array is approximately 400 m (1,312 ft) long, and the active part of the hydrophone array is approximately 56 m (184 ft) long. The hydrophone array is typically towed at depths less than 20 m (66 ft).

While the *Langseth* is in the seismic survey area, the towed hydrophone array will be monitored 24 hours per day while at the survey area during airgun operations and also during most periods when the *Langseth* is underway with the airguns not operating. One marine mammal observer (MMO) will monitor the acoustic detection system at any one time, by listening to the signals from two channels via headphones and/or speakers and watching the real time spectrographic display for frequency ranges produced by cetaceans. MMOs monitoring the acoustical data will be on shift for 1–6 hours. All MMOs are expected to rotate through the PAM position, although the most experienced with acoustics will be on PAM duty more frequently.

When a cetacean vocalization is detected, the acoustic MMO will, if visual observations are in progress, contact the MMVO immediately to alert him/her to the presence of the cetacean(s), if they have not already been seen and to allow power down or shutdown to be initiated, if required. The information regarding the call will be entered into a database. The data to be entered include an acoustic encounter identification number, whether it was linked with a visual sighting, date, time when first and last heard and whenever any additional information was recorded, position and water depth when first detected, bearing if determinable, species or species group (e.g., unidentified dolphin, sperm whale), types and nature of sounds heard (e.g., clicks, continuous, sporadic, whistles, creaks, burst pulses, strength of signal, etc.), and any other notable information. The acoustic detection can also be recorded for further analysis.

MMVO Data and Documentation

MMVOs will record data to estimate the numbers of marine mammals exposed to various received sound levels and to document any apparent disturbance reactions or lack thereof. Data will be used to estimate the numbers of mammals potentially ''taken'' by harassment. They will also provide information needed to order a power down or shutdown of airguns when marine mammals are within or near the EZ. When a sighting is made, the following information about the sighting will be recorded:

(1) Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from seismic vessel, sighting cue, apparent reaction to the airguns or vessel (e.g., none, avoidance, approach, paralleling, etc.), and behavioral pace.

(2) Time, location, heading, speed, activity of the vessel (shooting or not), sea state, visibility, cloud cover, and sun glare.

The data listed under (2) will also be recorded at the start and end of each observation watch and during a watch, whenever there is a change in one or more of the variables.

All mammal observations, as well as information regarding airgun power down and shutdown, will be recorded in a standardized format. Data accuracy will be verified by the MMVOs at sea, and preliminary reports will be prepared during the field program and summaries forwarded to the operating institution's shore facility and to NSF weekly or more frequently. MMVO observations will provide the following information:

(1) The basis for decisions about powering down or shutting down airgun arrays.

(2) Information needed to estimate the number of marine mammals potentially 'taken by harassment', which must be reported to NMFS.

(3) Data on the occurrence, distribution, and activities of marine mammals in the area where the seismic study is conducted.

(4) Data on the behavior and movement patterns of marine mammals seen at times with and without seismic activity.

Mitigation

Mitigation and monitoring measures proposed to be implemented for the proposed seismic survey have been developed and refined during previous L–DEO seismic studies and associated environmental assessments (EAs), IHA applications, and IHAs. The mitigation and monitoring measures described herein represent a combination of the procedures required by past IHAs for other similar projects and on recommended best practices in Richardson *et al.* (1995), Pierson *et al.* (1998), and Weir and Dolman (2007). The measures are described in detail below.

The number of individual animals expected to be approached closely during the proposed activity will be small in relation to regional and worldwide population sizes. With the proposed monitoring and mitigation provisions, any effects on individuals are expected to be limited to behavioral disturbance and will have only negligible impacts on the species and stocks.

Mitigation measures that will be adopted include: (1) Speed or course alteration, provided that doing so will not compromise operational safety requirements; (2) power-down procedures; (3) shutdown procedures; (4) ramp-up procedures; and (5) minimizing approaches to slopes and submarine canyons, if possible, because of sensitivity of beaked whales.

Speed or Course Alteration—If a marine mammal is detected outside the EZ but is likely to enter it based on relative movement of the vessel and the animal, then if safety and scientific objectives allow, the vessel speed and/or course will be adjusted to minimize the likelihood of the animal entering the EZ. Major course and speed adjustments are often impractical when towing long seismic streamers and large source arrays, thus for surveys involving large sources, alternative mitigation measures are required.

Power-down Procedures—A power-down involves reducing the number of operating airguns, typically to a single airgun (e.g., 40 in^3), to minimize the EZ, so that marine mammals are no longer in or about to enter this zone. A power-down of the airgun array to a reduced number of operating airguns may also occur when the vessel is moving from one seismic line to another. The continued operation of at least one airgun is intended to alert marine mammals to the presence of the seismic vessel in the area.

If a marine mammal is detected outside the EZ but is likely to enter it, and if the vessel's speed and/or course cannot be changed, the airguns will be powered down to a single airgun before the animal is within the EZ. Likewise, if a mammal is already within the EZ when first detected, the airguns will be powered down immediately. If a marine mammal is detected within or near the smaller EZ around that single airgun (see Table 1 of L–DEO's application and Table 1 above), all airguns will be shutdown (see next subsection).

Following a power down, airgun activity will not resume until the marine mammal is outside the EZ for the full array. The animal will be considered to have cleared the EZ if it:

(1) Is visually observed to have left the EZ; or

(2) Has not been seen within the EZ for 15 minutes in the case of small odontocetes and pinnipeds; or

(3) Has not been seen within the EZ for 30 minutes in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales.

Following a power-down and subsequent animal departure as above, the airgun array will resume operations following ramp-up procedures described below.

Shutdown Procedures—The operating airgun(s) will be shutdown if a marine mammal is detected within the EZ of a single 40 in^3 airgun while the airgun array is at full volume or during a power down. Airgun activity will not resume until the marine mammal has cleared the EZ or until the MMVO is confident that the animal has left the vicinity of the vessel. Criteria for judging that the animal has cleared the EZ will be as describing in the preceding subsection.

Ramp-up Procedures—A ramp-up procedure will be followed when the airgun array begins operating after a specified-duration period without airgun operations or when a power down has exceeded that period. It is proposed that, for the present cruise, this period would be approximately 8 minutes. This period is based on the modeled 180-dB radius for the 36-airgun array (see Table 3 of L–DEO's application and Table 1 here) in relation to the planned speed of the *Langseth* while shooting in deep water. Similar periods (approximately 8–10 minutes) were used during previous L–DEO surveys.

Ramp-up will begin with the smallest airgun in the array (40 in^3). Airguns will be added in a sequence such that the source level of the array will increase in steps not exceeding 6 dB per 5-minute period over a total duration of approximately 20–25 minutes. During ramp-up, the MMVOs will monitor the EZ, and if marine mammals are sighted, a course/speed change, power down, or shutdown will be implemented as though the full array were operational.

Initiation of ramp-up procedures from shutdown requires that the full EZ must be visible by the MMVOs, whether conducted in daytime or nighttime. This requirement likely will preclude start ups at night or in thick fog because the outer part of the EZ for that array will not be visible during those conditions. Ramp-up is allowed from a power down under reduced visibility conditions only if at least one airgun (e.g., 40 in^3 or similar) has operated continuously throughout the survey without interruption, on the assumption that marine mammals will be alerted to the approaching seismic vessel by the sounds from the single airgun and could move away if they choose. Ramp-up of the airguns will not be initiated if a marine mammal is sighted within or near the applicable EZ during the day or close to the vessel at night.

Minimize Approach to Slopes and Submarine Canyons—Although sensitivity of beaked whales to airguns is not known, they appear to be sensitive to other sound sources (e.g., mid-frequency sonar). Beaked whales tend to concentrate in continental slope areas and in areas where there are submarine canyons. There are no submarine canyons within or near the study area. Three of the transect lines are on the continental slope, which accounts for only a small portion of the proposed study area (207 km; 128.6 mi) and a minimal amount of time (30 hours).

Reporting

A report will be submitted to NMFS within 90 days after the end of the cruise. The report will describe the operations that were conducted and sightings of marine mammals near the operations. The report will be submitted to NMFS, providing full documentation of methods, results, and interpretation pertaining to all monitoring. The 90-day report will summarize the dates and locations of seismic operations, all marine mammal sightings (dates, times, locations, activities, associated seismic survey activities), and estimates of the amount and nature of potential ''take'' of marine mammals by harassment or in other ways.

Endangered Species Act (ESA)

Under section 7 of the ESA, NSF has begun consultation with the NMFS, Office of Protected Resources, Endangered Species Division on this proposed seismic survey. NMFS will also consult on the issuance of an IHA under section 101(a)(5)(D) of the MMPA for this activity. Consultation will be concluded prior to a determination on the issuance of the IHA.

National Environmental Policy Act (NEPA)

NSF prepared an Environmental Assessment of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* off Central America, January–March 2008. NMFS will either adopt NSF's EA or conduct a separate NEPA analysis, as necessary, prior to making a determination of the issuance of the IHA.

Preliminary Determinations

NMFS has preliminarily determined that the impact of conducting the seismic survey in the Pacific Ocean and Caribbean Sea off Central America may result, at worst, in a temporary modification in behavior (Level B Harassment) of small numbers of 26 species of marine mammals. Further, this activity is expected to result in a negligible impact on the affected species or stocks. The provision requiring that the activity not have an unmitigable adverse impact on the availability of the affected species or stock for subsistence uses does not apply for this proposed action.

For reasons stated previously in this document, this determination is supported by: (1) The likelihood that, given sufficient notice through relatively slow ship speed, marine mammals are expected to move away from a noise source that is annoying prior to its becoming potentially injurious; (2) the fact that marine mammals would have to be closer than 40 m (131 ft) in deep water, 60 m (197 ft) at intermediate depths, or 296 m (971 ft) in shallow water when a single airgun is in use from the vessel to be exposed to levels of sound (180 dB) believed to have even a minimal chance of causing TTS; (3) the fact that marine mammals would have to be closer than 950 m (0.6 mi) in deep water, 1,425 m (0.9 mi) at intermediate depths, and 3,694 m (2.3 mi) in shallow water when the full array is in use at a 9 m (29.5 ft) tow depth from the vessel to be exposed to levels of sound (180 dB) believed to have even a minimal chance of causing TTS; (4) the fact that marine mammals would have to be closer than 1,120 m (0.7 mi) in deep water, 1,680 m (1 mi) at intermediate depths, and 4,356 (2.7 mi) in shallow water when the full array is in use at a 12 m (39 ft) tow depth from the vessel to be exposed to levels of sound (180 dB) believed to have even a minimal chance of causing TTS; and (5) the likelihood that marine mammal detection ability by trained observers is high at that short distance from the vessel. As a result, no take by injury or death is anticipated, and the potential for temporary or permanent hearing impairment is very low and will be avoided through the incorporation of the proposed mitigation measures.

While the number of potential incidental harassment takes will depend on the distribution and abundance of marine mammals in the vicinity of the survey activity, the number of potential harassment takings is estimated to be small, less than a few percent of any of the estimated population sizes, and has been mitigated to the lowest level practicable through incorporation of the measures mentioned previously in this document.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to L–DEO for conducting a marine geophysical survey in the Pacific

Ocean and Caribbean Sea off Central America from February–April, 2008, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: December 12, 2007.

Helen Golde,

Deputy Director, Office of Protected Resources, National Marine Fisheries Service.

[FR Doc. E7–24508 Filed 12–17–07; 8:45 am]

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XE39

Gulf of Mexico Fishery Management Council; Public Meeting

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice of a public meeting.

SUMMARY: The Gulf of Mexico Fishery Management Council will convene a public meeting of the Shrimp Advisory Panel (AP).

DATES: The Shrimp AP meeting is scheduled to begin at 8:30 a.m. on Wednesday, January 9, 2008.

ADDRESSES: The meeting will be held at the Hilton Houston Hobby Airport, 8181 Airport Blvd., Houston, TX 77061.

Council address: Gulf of Mexico Fishery Management Council, 2203 North Lois Avenue, Suite 1100, Tampa, FL 33607.

FOR FURTHER INFORMATION CONTACT: Dr. Richard Leard, Deputy Executive Director; telephone: (813) 348–1630.

SUPPLEMENTARY INFORMATION: The Shrimp AP will receive reports from the National Marine Fisheries Service (NMFS) on the status and health of the shrimp stocks in 2006, as well as a report on the biological and economic aspects of the 2007 Cooperative Shrimp Closure with the state of Texas. The Shrimp AP may make recommendations for a cooperative closure with Texas for 2008. The Shrimp AP will also receive a presentation of the current number of moratorium permits that have been issued by the NMFS and preliminary estimates of offshore shrimping effort in 2007. Finally, the Shrimp AP may discuss and make recommendations regarding a Generic Offshore Aquaculture Amendment being developed by the Council.

The Shrimp AP consists principally of commercial shrimp fishermen, dealers, and association representatives.

Although other non-emergency issues not on the agenda may come before the Shrimp AP for discussion, in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), those issues may not be the subject of formal action during these meetings. Actions of the Shrimp AP will be restricted to those issues specifically identified in the agenda and any issues arising after publication of this notice that require emergency action under Section 305(c) of the Magnuson-Stevens Act, provided the public has been notified of the Council's intent to take action to address the emergency.

Copies of the agenda can be obtained by calling (813) 348–1630.

Special Accommodations

This meeting is physically accessible to people with disabilities. Requests for sign language interpretation or other auxiliary aids should be directed to Tina Trezza at the Council (see **ADDRESSES**) at least 5 working days prior to the meeting.

Dated: December 13, 2007.

Tracey L. Thompson,

Acting Director, Office of Sustainable Fisheries, National Marine Fisheries Service.

[FR Doc. E7–24448 Filed 12–17–07; 8:45 am]

BILLING CODE 3510–22–S

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XE40

Gulf of Mexico Fishery Management Council; Public Meeting

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice of a public meeting.

SUMMARY: The Gulf of Mexico Fishery Management Council will convene a joint meeting of The Standing and Special Reef Fish Scientific and Statistical Committees (SSC).

DATES: The Joint Standing and Special Reef Fish SSC meeting will begin at 1:30 p.m. on Wednesday, January 9, 2008 and conclude by 12 noon on Thursday, January 10, 2008.

ADDRESSES: The meeting will be held at the Hilton Hobby, 8181 Airport Blvd., Houston, TX 77061.

Council address: Gulf of Mexico Fishery Management Council, 2203 North Lois Avenue, Suite 1100, Tampa, FL 33607.

FOR FURTHER INFORMATION CONTACT: Dr. Richard Leard, Deputy Executive Director; Gulf of Mexico Fishery Management Council; telephone: (813) 348–1630.

SUPPLEMENTARY INFORMATION: The Joint Standing and Special Reef Fish SSC will review a Generic Amendment for Offshore Aquaculture that contains provisions for allowing and regulating potential offshore aquaculture operations in the Exclusive Economic Zone (EEZ) of the Gulf of Mexico. The SSCs will also review Amendment 30B to the Reef Fish FMP that contains provisions for potential additional regulations on gag and potentially reducing regulations on red grouper in the EEZ Gulf of Mexico. Finally, the SSCs may also discuss potential adjustments to the deep-water grouper and tilefish total allowable catch levels (TACs).

Copies of the agenda and other related materials can be obtained by calling (813) 348–1630.

Although other non-emergency issues not on the agenda may come before the SSCs for discussion, in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), those issues may not be the subject of formal action during this meeting. Actions of the SSCs will be restricted to those issues specifically identified in the agenda and any issues arising after publication of this notice that require emergency action under Section 305(c) of the Magnuson-Stevens Act, provided the public has been notified of the Council's intent to take action to address the emergency.

Special Accommodations

This meeting is physically accessible to people with disabilities. Requests for sign language interpretation or other auxiliary aids should be directed to Tina Trezza at the Council (see **ADDRESSES**) at least 5 working days prior to the meeting.

Dated: December 13, 2007.

Tracey L. Thompson,

Acting Director, Office of Sustainable Fisheries, National Marine Fisheries Service.

[FR Doc. E7–24449 Filed 12–17–07; 8:45 am]

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